

Testimony

of

Citizens Against Overhead Power Line Construction

prepared for the

Connecticut Siting Council and the Massachusetts EFSB

for the

Greater Springfield Reliability Project/ NEEWS Projects Hearings

Citizens Against Overhead Power line Construction

Table of Contents

Preface	3
A Citizen’s Perspective of the Siting Process	6
EMF Radiation.....	8
Dose/Response curve	11
Problems with the Linear Dose/Response Model	12
INTRODUCTION TO TOXICOLOGY	12
MEASURES OF EXPOSURE	12
DOSE-EFFECT RELATIONSHIPS	13
Gene Mutations and Childhood Leukemia Risk	14
Toxicogenomics.....	14
HVDC Technology – Background Information, Technical Applications and Costs.....	16
Notes and commentary on HVDC technology.	18
HVDC Light	18
Applications of HVDC Light	19
Other compelling and important HVDC documents for CSC and MA EFSB review:	20
HVDC and Renewable Energy	21
Visual and Environmental Impacts of the GSRP	25
Property Values.....	28
Final Comments	30

Citizens Against Overhead Power line Construction

<p>The Connecticut Light & Power Company application for Certificates of Environmental Compatibility and Public Need for the Connecticut Valley Electric Transmission Reliability Projects which consists 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.</p>	<p>CT DOCKET No. 370</p> <p>September 15, 2009</p>
---	--

Citizens Against Overhead Power Line Construction Prefiled Testimony

Testimony of Richard Legere Executive Director, CAOPLC

1 **Preface**

2

3 I am addressing my comments to the CSC as Executive Director of Citizens Against Overhead Power Line
4 Construction (CAOPLC).

5

6 CAOPLC began as a grassroots advocacy group representing the Suffield and East Granby families who
7 have serious concerns about the adverse impacts of CL&P's proposed NEEWS/GSRP 345,000 volt
8 overhead alternating current power lines. CAOPLC is now receiving emails and meeting with town
9 officials through the NEEWS project area. It seems that what could be viewed as our "backyard"
10 concerns are shared by a wide group of individuals throughout the NEEWS project area.

11

12 To be clear, we are not a NIMBY (not in my backyard) group. It would be foolish to argue against having
13 reliable electric energy. It would be equally foolish and inappropriate to argue that utility ratepayers
14 should be paying as much as possible for that energy. If there is a need for the power lines, our
15 concerns and opposition comes in how they are constructed and the disproportionate share of the
16 adverse impacts the a select few families will have to shoulder and endure.

17

18 We do not think that power line construction should be, and has to be, a zero sum game. That is where
19 NU, CL&P, WMECO and ISO-NE are winners and everyone else who lives in a power line sited community
20 or neighboring community loses.

21

Citizens Against Overhead Power line Construction

22 Since the scope of the joint CT/MA hearings is to encompass “the environmental impacts and cost and
23 reliability concerns of the Northern and Southern routes, exclusive of need” we will start with a
24 definition of “environmental” so that our testimony follows that direction. Webster’s Dictionary defines
25 “Environmental” as:

26

27 (1) The circumstances, objects, or conditions by which one is surrounded;

28

29 (2a) The complex of physical, chemical, and biotic factors (as climate, soil, and living
30 things) that act upon an organism or an ecological community and ultimately
31 determine its form and survival;

32

33 (2b) the aggregate of social and cultural conditions that influence the life of an
34 individual or community;

35

36 (3) The position or characteristic position of a linguistic element in a sequence;

37

38 (4) A computer interface from which various tasks can be performed <a
39 programming *environment*>.

40

41 Given Webster’s definition of “environmental”, here are the main concerns of the families whose
42 property abuts or shares its land with the CL&P right of way:

43

44 • Our health and safety, particularly the health of our children and grandchildren from the EMF
45 radiation from CL&P’s proposed 345 kV AC overhead lines.

46

47 • The visual pollution of any power transmission tower that would be located in the Newgate area
48 of East Granby and West Suffield. The CL&P Newgate area right of way (ROW) borders and runs
49 parallel to the Metacomet Trail. The Metacomet Trail was recently awarded a national historic
50 heritage trail designation, a designation similar to the Appalachian Trail. All Metacomet area
51 residents share a deep concern about the extraordinary visual pollution that will occur. Of ten (10)
52 to thirteen (13) story power towers. It will scar a beautiful scenic, pastoral and historic area and
53 damage it irreparably.

54

55 • Severe erosion and water runoff problems in the Phelps Road area in West Suffield which is also
56 in the Newgate area and along Metacomet trail. On the southern part of Phelps Road there are a
57 number of homes on a steep slope that currently experience heavy water runoff problems when
58 there are moderate to heavy rains and in springtime with the spring rains and snow melt. Any
59 further clearing of the right of way will exacerbate those erosion and runoff problems and cause
60 erosion and water runoff problems not only for the southern high slope residents but the lower
61 slope residents on the northern side of the road who receive the runoff waters.

62

63 • We have concerns about the possible serious loss of our property values for overhead power
64 lines. Estimated run from a few thousand dollars for some homes, to in the case of a few homes, in
65 the hundreds of thousands to the million dollar range.

66

67 • We have concerns that the possible loss of our property values will impact our small town’s tax
68 base and cause a financial “ripple effect” through our local businesses such as Realtors and

Citizens Against Overhead Power line Construction

69 contractors and other small, local shops and service businesses struggling through a recessionary
70 economy.

71

72 • We have concerns specifically about the impact of EMFs on children who do not reside in or
73 along the CL&P ROW. While there are no public schools presently located near the proposed power
74 lines, there are a number of facilities that have or sponsor recreational events that do. A good
75 example is the Suffield Sportsman Club. I have been at the club during events to gather signatures
76 for our petition. I have been struck by the number of children who attend events such as a Turkey
77 Shoot.

78

79 • We have concerns about the impact on our agricultural lands. Suffield in particular is proud of
80 its heritage as a farming community, a tradition that dates back to the 1600's. We think that by
81 recognizing the unique attributes, culture and benefits of each community, and that preserving the
82 local uniqueness, local flavor from unnecessary or inappropriate power transmission development,
83 preserving and promoting community diversity will benefit all of Connecticut's and Massachusetts's
84 small towns by helping to sustain those attributes, landscapes and the quality of life we hold dear.

85

86 There is another overarching concern that we have, that of the unresponsiveness of CL&P to its local,
87 resident ROW ratepayers and why CL&P behaves in this way. We saw signs of it in our many
88 "community outreach"¹ discussions with CL&P where we tried to explain our concerns and suggest
89 alternative designs that addressed our concerns, such as alternative siting options, alternative
90 transmission pole designs, and ways to mitigate EMF's. But as they say actions speak louder than words
91 and it was clear by CL&P's actions that CL&P had its plans and designs firmly set and was unwilling to
92 offer any realistic and meaningful modifications. And it was that unwillingness and intransigence that
93 we did not understand at the time.

94

95 CL&P will say that they did plan a number of underground variations. That is true. But the underground
96 variations are unworkable and unrealistic. Members of our group met with CL&P's representatives this
97 summer (2009) during both in-home meetings and community meetings. A significant number of
98 people voiced strong concerns about EMF radiation from the 345 kV power line, especially with regard
99 to their children and grandchildren's health. We are at the beginning stages of a petition drive and
100 currently have the signatures of over 200 Suffield and East Granby residents who are concerned about
101 the significant health risks such as childhood leukemia and the adverse economic effects of a high
102 voltage overhead power line. Although we have expressed our concerns, CL&P has refused to
103 adequately address this issue, entertain the siting or construction options we suggest, or even attempt
104 to reassure us other than to say (incorrectly)the World Health Organization says EMF's from power lines
105 are safe.

106

107 So, what has CL&P proposed to the CT Siting Council as its alternative plans for underground routes?

108

109 Two of the alternative plans dig up either Newgate Road or Routes 20 and 187 in East Granby and West
110 Suffield. Among some of the many unacceptable affects of these alternative plans, is that CL&P
111 proposes to bury its 345kV AC lines under the roadways so that we, our children and grandchildren, will
112 drive over them numerous times each day for miles at a time. This "solution" will most likely
113 dramatically INCREASE our EMF exposure over that of a 345 kV overhead power line.

¹ "Outreach" is CL&P's term. If CL&P was responsive to the public's concerns there would not be grass roots advocacy groups like CAOPLC.

Citizens Against Overhead Power line Construction

114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157

In order to sway public opinion to believe that the overhead power lines are the least of all evils, CL&P's underground proposals seem specifically developed to destroy the historic Newgate Road and Metacomet Trail landscape, as well as disrupt people's lives and subject them to as much inconvenience as possible in the construction process which CL&P says will last for years.

CL&P's "alternate underground plan" for Newgate Road risks the possible collapse of the historic Old Newgate Prison, a National Historic Register property, by routing the proposed underground power line's tunnels adjacent to its foundation and the copper mine's underground tunnels. Personally, I cannot understand how and why professional engineers can proffer such absurd solutions. A logical explanation seems to be that CL&P is intentionally proposing dead-on-arrival construction alternatives.

If these two options are dismissed, that will leave only an overhead 345 kV AC power line and the underground 345 kV AC option through the existing right of way. We believe it is CL&P's express purpose to offer alternative underground plans so objectionable, so unworkable and so patently ridiculous that underground construction solutions are discarded as options by the CT Siting Council. If so, CL&P is making a mockery of the intent of CT 04-246, the siting process and us as its customers.

A Citizen's Perspective of the Siting Process

If we could use the above story as the foundation for the first topic for CAOPLC's testimony, we would like to address what it is like to participate as a citizen and a citizens group in the environment of the siting process and its hearings.

The environment that a citizens group operates within in the siting process and its hearings is one in which they are obviously not the subject matter experts or anything reasonably close to it. And that is especially true in the early days of participation. It is a very steep learning curve. We are not experts in electrical power transmission engineering. Nor are we economic modeling experts or expert in the ways in which the short and long term power generation markets are designed and function. We are not expert, practicing professionals on the specific environmental issues of power transmission construction. Typically, we are not lawyers. Those citizens who are lawyers are typically not experienced in administrative law and the siting process, nor in state and federal utility regulations. We do not have expertise as financial professionals in how power transmission projects are subsidized and financed over the project's long term life cycle.

From researching the issues of power line transmission for a year, it seems that citizens groups universally travel down the same rocky path. We don't know what we don't know until we reach the point, through research, that we don't know it.

For example, we did not understand why CL&P is so unresponsive to its rate payers' concerns about the potential for adverse health and safety effects of the GSRP and is so steadfast in its insistence to advocating its base design for the GSRP transmission line despite all of the concern voiced by so many people.

Citizens Against Overhead Power line Construction

158 Once we realized after researching NU/CL&P's business structure and the utility franchise that grants
159 CL&P the authority to operate monopolistically in its territory, we understood. CL&P², or properly
160 Northeast Utilities (NU), like any other stockholder owned and as a majority institutionally owned
161 corporation has a strict fiduciary duty to its largely institutional shareholders. They have no fiduciary
162 duty or obligation to us, the families and residents who are their customers and ratepayers. Rather, NU
163 and CL&P and WMECO stand in opposition to its ratepayer customers adopting an in loco parentis
164 position of, trust us we know what is best for you, advocacy for its transmission projects. And as NU's
165 CEO, Mr. Shivery has often said to institutional analysts, "NU's core competency is sourcing and building
166 transmission lines."

167
168 Somehow, and through what some of our members referred to as divine intervention, we were able to
169 retain the pro bono services of our attorney, Matt McGrath. Prior to that watershed day of Mr.
170 McGrath's agreement to represent CAOPLC, we diligently searched and researched our legal options to
171 be able to challenge the "parental beneficence" of NU and CL&P and the GSRP. Most law firms
172 experienced in utility law estimated the costs for representation at the CSC evidentiary hearings at
173 \$100,000 to \$300,000 depending on how many expert witnesses we wanted to present. Clearly, it is a
174 very uneven playing field that we are on, an environment not conducive to citizens groups' being able to
175 present and advocate for our concerns.

176
177 And as Mr. McGrath explained, our legal process is an adversarial process. Which further explains why
178 the local families of East Granby and Suffield could not understand, from our parochial perspective at
179 least, why CL&P did not seem to care about us. CL&P is not required to concern itself with CAOPLC and
180 its members, they have no fiduciary duty to care, indeed NU or CL&P could risk a shareholder lawsuit if
181 they did not conduct its affairs with the best interest of its shareholders at the forefront no matter how
182 harmful they may be to local residents. And fixing that dysfunctional situation is beyond the scope of
183 the siting process.

184
185 So we, the families and citizens who are affected by the NEEWS/GSRP power lines, understand the great
186 challenges and responsibilities that are placed in both the CSC and MA EFSB. We ask for your
187 consideration because we are still researching and learning. We feel that to not have done our home
188 work and to come unprepared to these hearings would be a disservice to the families who depend on
189 us, to the siting process and even to the applicant, CL&P and WMECO.

190
191 We view our role and value to the siting process is one that is analogous to hunting Truffles. We root
192 around to research and identify alternatives. We root some more and ask questions where
193 contradictions and inconsistencies are apparent, and bring forth the information that would help the
194 siting process to achieve a solution that is the best possible, long term use of what is not NU or CL&P's
195 money, but that of its rate payers. Because as CL&P has testified at the CSC, and I am paraphrasing, it is
196 not their money that is ultimately spent on the power lines, it is ratepayers' money.

197
198 **We believe that transmission and utility infrastructure construction should not be a zero sum game,**
199 **where the weakest and least able to advocate for their health, safety and well being are the losers**
200 **and those with the most money win and prevail.** With these as our opening comments, we will briefly
201 address each major concerns.
202

² WE will from this point in time use CL&P and NU (Northeast Utilities) interchangeably to refer to inclusively, CL&P, WMECO and NU.

Citizens Against Overhead Power line Construction

203 **EMF Radiation**

204 There is no scientific consensus on EMF radiation. CAOPLC cannot unequivocally say EMF radiation is
205 unsafe; nor can NU or CL&P or WMECO say with 100% certainty that overhead any alternating current
206 high voltage power line's EMF radiation is safe and harmless.

207
208 The scientific community seems to be split on this issue. The BioInitiative Report's scientists and many
209 other scientists feel that EMF are harmful and harmful to the point of being deadly. Of particular
210 concern is childhood leukemia. The WHO has classified EMF's as a "possible carcinogen" and has
211 recommended further prioritized research. We still do not know and may not know for a few years.

212
213 And here is our perspective on the matter of EMF and the public's health and safety: First of all, we ask
214 that all due consideration is given by the CSC and MA EFSB to our health and safety. That is consistent
215 with the intent as we read it of CT law 04-246 that requires underground construction of power lines in
216 residential area and especially near those areas in which children are present. As we have said, it is a
217 grossly uneven playing field that we are on and while we feel strongly, passionately about our health
218 and safety risks from the GSRP, we cannot mount the kind of strong and vigorous defense that we could
219 if we had CL&P's resources and access to experts. And the irony is, as we understand it from the docket
220 370 testimony, is that CL&P's money and vigorous advocacy is eventually incorporated into its expenses
221 and charged back to its rate payers. Our own money is used against us.

222
223 While the science is still evolving on EMF's, we feel that the prudent public policy to follow is to require
224 underground construction for high voltage power lines. Once research shows EMF's to be a direct
225 cancer risk, what will Connecticut's and Massachusetts's recourse be against NU, CL&P and WMECO
226 after billions are spent to construct overhead power lines? Do we spend billions more to tear down the
227 overhead lines and build the high voltage lines like we should have in the first place? Or do we go into
228 the "acceptable levels of fatalities" risk analysis mode and do the calculus on how many children and
229 adult deaths are acceptable?

230
231 Our collective history on being proactive and on the right side of public health issues for potentially
232 hazardous substances is not a good one. There is a famous quote from George Santayana about "Those
233 who forget history are condemned to repeat it." We once thought Asbestos was safe and a wonder
234 material. It found its way into commercial and residential insulation, automotive break shoes and
235 number of other commercial and residential insulation and heat shielding applications. Here is a
236 sampling of substances and chemicals that were once approved by government regulators, substances
237 that caused billion in remediation and litigation expenses.

238

TOXIC CHEMICALS AND SUBSTANCES ONCE APPROVED AND NOW BANNED BY THE FEDERAL GOVERNMENT	
Arsenic	Asbestos
Lead Paint	Mercury
DDT	CFC's
Alar	Thimerisol
Thalidimide	2-4 D
2-4-5 T Agent	MBTE (in gasoline)
Orange	
DES	PCB's & Dioxin (endocrine function disruptors)

Citizens Against Overhead Power line Construction

239
240 No one can yet answer definitively if EMF's will join this group but we once again have the opportunity
241 to either learn from history or have history repeat itself.

242
243 At the CSC much testimony has been given by the applicant to various plans and solutions to achieve
244 reductions in EMF levels at the edge of the right of way. I do not think our concerns or comments on
245 this issue has been fully realized, it certainly has not been heard by CL&P because they have not
246 addressed it other than to dismiss our concern. **And our concern is this, in our community, an**
247 **agricultural community one in which people have more that a suburban lot, edge of the right of way**
248 **considerations are meaningless because we travel under the power lines a number of times each day.**
249 **We are in the right of way much more than most suburban and city residents. We therefore feel our**
250 **concerns about EMF exposure are real and warranted.**

251
252 We asked in our interrogatories to CL&P a number of questions about EMFs. Here is the statement that
253 prefaced our EMF interrogatory questions:

254
255 "We could take some comfort in CL&P's quoted EMF number of 2.7 mG at our house at a
256 distance of 350 feet from the edge of the power line ROW, if we intended to stay locked in our
257 homes and not ever venture out. But that is not why someone buys acreage property or
258 chooses to live in the country vs. a city. We spend time outdoors, walking, cross country
259 skiing in the winter, walking our dogs up to Newgate Road and beyond, my orchard in
260 particular is much closer to the power lines, and we do work in our fields like mowing and tree
261 and fire wood cutting – there is a lot of outdoor activity – and that holds true for all of the
262 residents in our area especially for families with children. Given the above prefaced situation
263 and importantly that that CL&P has quoted a 200 mG reading directly below the proposed
264 GSRP 345 kV power line, our questions are these: "

265
266 CL&P' responses include, *"The cited statement is descriptive. Unless a person spent a large fraction of*
267 *the year on or very close to the right-of-way, variations in the height of the line conductors would have a*
268 *minor influence on their average long-term exposure."*³

269
270 My Mom had a great saying when my brother and I were growing up, **"You are hard of listening."** If this
271 is not a profound example of CL&P's being deliberately hard of listening to respond to a statement that
272 details all of the ways that rural residents do actually spend *"a large fraction of the year on or very close*
273 *to the right-of-way,"* then I do not know what is.

274
275 CL&P also responded in writing to a different EMF interrogatory question that, *"CL&P's representatives*
276 *verbally stated at the referenced (town) meetings that no public health risk of transmission line EMF*
277 *exposure has been established after several decades of research on this topic."*⁴

278
279 Here is a statement from the report of the British Children with Leukaemia Foundation, a charity
280 founded by Princess Diana:

281
282 **Electric and magnetic fields (EMF) are created by the presence of electricity. They**
283 **surround us in modern life and are produced in varying degrees and strengths by all**

³ CL&P response Q-CAOPLC-004 6/30/09

⁴ CL&P response Q-CAOPLC-01 6/30/09

Citizens Against Overhead Power line Construction

284 elements of the electricity supply system – from high voltage power lines to the electrical
285 appliances in our homes. EMF have come under scrutiny as a possible source of harm
286 and have been blamed for a wide range of adverse health effects. A great deal of
287 research has been carried out investigating these possible effects, with mixed results.
288 Perhaps the largest body of evidence relates to childhood leukaemia where there is now
289 the strongest evidence of a link.

291 And the report goes on to conclude and the red highlighting is the Children with Leukaemia
292 Foundation’s report’s highlighting and not CAOPLC’s highlighting:

293 Do electric and magnetic fields cause childhood leukaemia?

294 **Following our review of the evidence, we have to say we don't know - yet. We believe**
295 **that there is good epidemiological evidence for a doubling of risk of childhood**
296 **leukaemia in children exposed to EMF above a certain level (0.4 μ T). To progress from**
297 **this to a proof that EMF are a cause of childhood leukaemia is a big jump and, at this**
298 **stage, not clearly supported by the biological evidence although we have perhaps moved**
299 **on from ‘implausible’ to ‘plausible’. More research work needs to be done and this**
300 **report ends with some recommendations for future studies.**

303 Here is the key point that we think is not yet at the forefront of EMF discussion with regard to the GSRP.
304 The EMF threshold referenced in the above report is 0.4 μ T. The conversion for microTesla to
305 MilliGauss is to multiply microTesla by a factor of 10.⁵

307 The British study is concerned about “plausible” epidemiological associations at what amounts to a 4
308 milliGauss level. The 200 milliGauss level that CL&P says we will experience as we travel near or under
309 the GSRP power lines is 50 times that of the threshold in this study. We have found that a large number
310 of the scientific studies on EMF’s are based on these lower single digit milliGauss levels. We know of no
311 study and it appear that CL&P does not know of one either from its answer to our interrogatory
312 question shown below. CL&P responded with “*CL&P knows of no epidemiological study of this type the*
313 *question describes ever being performed or proposed.*”

315
316 “Question: We want a chart or study that shows cancer and/or any other health risks vs. time
317 exposed at 115 kV and 345 kV EMF levels. Can CL&P furnish epidemiological data such as this?
318 Given all of the data presented by CL&P in CSC docket 272, did CL&P or its expert witnesses
319 present this type of information? Can and will CL&P present this data at the docket 370a
320 evidentiary hearings, why or why not?”

321
322 And CAOPLC offered this example as a way to explain our concern about Annual Average Load
323 calculations and ask questions as to why we think AAL is a very misleading metric and why CL&P is using
324 it:

325
326 “Here is an explanation of why metrics like the AAL are not meaningful especially to a layperson
327 concerned about his or her EMF exposures and cancer risk: Suppose I had a Ferrari. If my
328 average speed for a six hour European trip was 55 mph that sounds very responsible and safe.
329 But what if I then told you that I derived that average speed by travelling back roads at 37 mph
330 for most of the trip with a couple of bursts to 170 mph on the German Autobahn?

⁵ This formula was offered by CL&P in response to CAOPLC interrogatory question Q-CAOPLC-002.

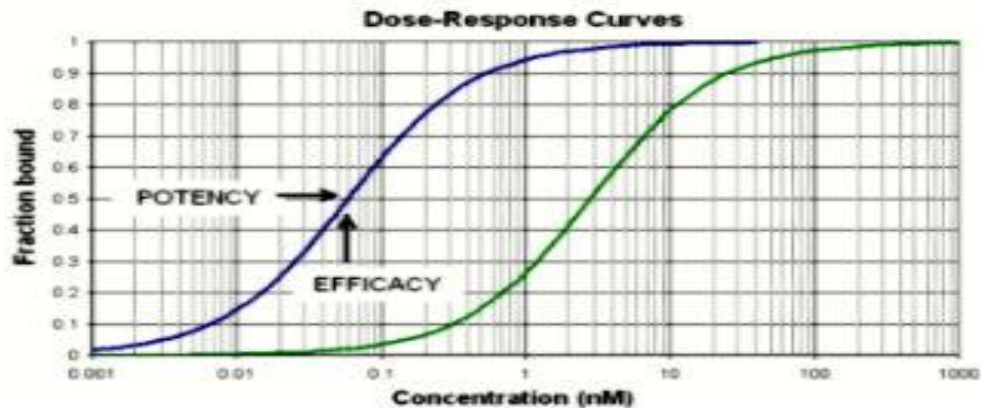
Citizens Against Overhead Power line Construction

331
332 The average speed is not problematic or dangerous, the maximum speed is. An average EMF
333 without quantifying the low and high boundary numbers is very misleading and of little or no
334 value.”

335
336 CL&P response was: “ *The analogy between the speed of a vehicle to the current flow on a transmission*
337 *line is flawed. While there is a clear relationship between increased (sic) in the speed of a vehicle and the*
338 *increase in the risk of harm, such is not the case with respect to EMF exposures.*”

339
340 With all due respect, CL&P’s answer is wrong. We were asking through an example about the
341 dose/response curve. We were asking for CL&P’s response using one of the most basic principles of
342 toxicology and pharmacology: that different concentrations of any substance will produce different
343 effects. And since most EMF studies and concerns are at the single digit milliGauss level and our
344 potential EMF exposure will be in the 200 milliGauss and above range, it is certainly a subject worth
345 exploring.

346 ***Dose/Response curve***



347
348
349 Here is some further information on the dose/response relationship:

350 A **dose-response curve** is a simple [X-Y graph](#) relating the magnitude of a stressor (e.g.
351 concentration of a pollutant, amount of a drug, temperature, intensity of radiation) to the
352 response of the [receptor](#) (e.g. organism under study). The response may be a physiological or
353 biochemical response, or even death (mortality). A number of other effects (or endpoints) can be
354 studied.

355 The measured [dose](#) (usually in [milligrams](#), [micrograms](#), or [grams](#) per kilogram of body-weight)
356 is generally plotted on the X axis and the response is plotted on the Y axis. Commonly, it is the
357 [logarithm](#) of the dose that is plotted on the X axis, and in such cases the curve is typically
358 [sigmoidal](#), with the steepest portion in the middle.

359 The first point along the graph where a response above zero is reached is usually referred to as a
360 [threshold-dose](#). For most beneficial or recreational drugs, the desired effects are found at doses
361 slightly greater than the threshold dose. At higher doses, undesired [side effects](#) appear and grow
362 stronger as the dose increases. The stronger a particular substance is, the steeper this curve will

Citizens Against Overhead Power line Construction

363 be. In quantitative situations, the Y-axis usually is designated by percentages, which refer to the
364 percentage of users registering a standard response (which may be death, as in [LD₅₀](#)). Such a
365 curve is referred to as a quantal dose response curve, distinguishing it from a graded dose
366 response curve, where response is continuous.⁶

367 ***Problems with the Linear Dose/Response Model***

368 Problems exist regarding non-linear relationships between dose and response, thresholds reached
369 and 'all-or-nothing' responses. These inconsistencies can challenge the validity of judging
370 causality solely by the strength or presence of a dose-response relationship. A [threshold model](#) or
371 [linear no-threshold model](#) may be more appropriate, depending on the circumstances.

372 [Endocrine disruptors](#) have also been cited with producing one effect at high dose and a different
373 effect at low doses.

374 ***INTRODUCTION TO TOXICOLOGY***⁷

375 The science of toxicology is based on the principle that there is a relationship between a toxic reaction
376 (the response) and the amount of poison received (the dose). An important assumption in this
377 relationship is that there is almost always a dose below which no response occurs or can be measured. A
378 second assumption is that once a maximum response is reached any further increases in the dose will
379 not result in any increased effect.

380 One particular instance in which this dose-response relationship does not hold true is in regard to true
381 allergic reactions. Allergic reactions are special kinds of changes in the immune system; they are not
382 really toxic responses. The difference between allergies and toxic reactions is that a toxic effect is
383 directly the result of the toxic chemical acting on cells. Allergic responses are the result of a chemical
384 stimulating the body to release natural chemicals which are in turn directly responsible for the effects
385 seen. Thus, in an allergic reaction, the chemical acts merely as a trigger, not as the bullet.

386 For all other types of toxicity, knowing the dose-response relationship is a necessary part of
387 understanding the cause and effect relationship between chemical exposure and illness. As Paracelsus
388 once wrote, "The right dose differentiates a poison from a remedy." Keep in mind that the toxicity of a
389 chemical is an inherent quality of the chemical and cannot be changed without changing the chemical to
390 another form. **The toxic effects on an organism are related to the amount of exposure.**

391 ***MEASURES OF EXPOSURE***

392 Exposure to poisons can be intentional or unintentional. The effects of exposure to poisons vary with
393 the amount of exposure, which is another way of saying "the dose." Usually when we think of dose, we
394 think in terms of taking one vitamin capsule a day or two aspirin every four hours, or something like
395 that. Contamination of food or water with chemicals can also provide doses of chemicals each time we
396 eat or drink. Some commonly used measures for expressing levels of contaminants are listed in table 1.
397 These measures tell us how much of the chemical is in food, water or air. The amount we eat, drink, or
398 breathe determines the actual dose we receive.

⁶ Material is from Wikipedia.

⁷ Material is excerpted from <http://pmep.cce.cornell.edu/profiles/extoxnet/TIB/dose-response.html>

Citizens Against Overhead Power line Construction

399 Concentrations of chemicals in the environment are most commonly expressed as ppm and ppb.
400 Government tolerance limits for various poisons usually use these abbreviations. Remember that these
401 are extremely small quantities. For example, if you put one teaspoon of salt in two gallons of water the
402 resulting salt concentration would be approximately 1,000 ppm and it would not even taste salty!

403

Dose	Abbrev.	Metric equivalent	Abbrev.	Approx. amt. in water
parts per million	ppm	milligrams per kilogram	mg/kg	1 teaspoon per 1,000 gallons
parts per billion	ppb	micrograms per kilogram	ug/kg	1 teaspoon per 1,000,000 gallons

404 ***DOSE-EFFECT RELATIONSHIPS***

405 The dose of a poison is going to determine the degree of effect it produces. The following example
406 illustrates this principle. Suppose ten goldfish are in a ten-gallon tank and we add one ounce of 100-
407 proof whiskey to the water every five minutes until all the fish get drunk and swim upside down.
408 Probably none would swim upside down after the first two or three shots. After four or five, a very
409 sensitive fish might. After six or eight shots another one or two might. With a dose of ten shots, five of
410 the ten fish might be swimming upside down. After fifteen shots, there might be only one fish swimming
411 properly and it too would turn over after seventeen or eighteen shots.

412 The effect measured in this example is swimming upside down. Individual sensitivity to alcohol varies, as
413 does individual sensitivity to other poisons. There is a dose level at which none of the fish swim upside
414 down (no observed effect). There is also a dose level at which all of the fish swim upside down. The dose
415 level at which 50 percent of the fish have turned over is known as the ED50, which means effective dose
416 for 50 percent of the fish tested. The ED50 of any poison varies depending on the effect measured. In
417 general, the less severe the effect measured, the lower the ED50 for that particular effect. Obviously
418 poisons are not tested in humans in such a fashion. Instead, animals are used to predict the toxicity that
419 may occur in humans.

420 One of the more commonly used measures of toxicity is the LD50. The LD50 (the lethal dose for 50
421 percent of the animals tested) of a poison is usually expressed in milligrams of chemical per kilogram of
422 body weight (mg/kg). A chemical with a small LD50 (like 5 mg/kg) is very highly toxic. A chemical with a
423 large LD50 (1,000 to 5,000 mg/kg) is practically non-toxic. The LD50 says nothing about non-lethal toxic
424 effects though. A chemical may have a large LD50, but may produce illness at very small exposure levels.
425 It is incorrect to say that chemicals with small LD50s are more dangerous than chemicals with large
426 LD50s, they are simply more toxic. The danger, or risk of adverse effect of chemicals, is mostly
427 determined by how they are used, not by the inherent toxicity of the chemical itself.

428 The LD50s of different poisons may be easily compared; however, it is always necessary to know which
429 species was used for the tests and how the poison was administered (the route of exposure), since the
430 LD50 of a poison may vary considerably based on the species of animal and the way exposure occurs.
431 Some poisons may be extremely toxic if swallowed (oral exposure) and not very toxic at all if splashed
432 on the skin (dermal exposure). If the oral LD50 of a poison were 10 mg/kg, 50 percent of the animals
433 who swallowed 10 mg/kg would be expected to die and 50 percent to live. The LD50 is determined
434 mathematically, and in actual tests using the LD50, it would be unusual to get an exact 50%
435 response. One test might produce 30% mortality and another might produce 70% mortality.

Citizens Against Overhead Power line Construction

436 Averaged out over many tests, the numbers would approach 50%, if the original LD50 determination
437 was valid.

438 The potency of a poison is a measure of its strength compared to other poisons. The more potent the
439 poison, the less it takes to kill; the less potent the poison, the more it takes to kill. The potencies of
440 poisons are often compared using signal words or categories as shown in the example in table 2.

441 The designation toxic dose (TD) is used to indicate the dose (exposure) that will produce signs of toxicity
442 in a certain percentage of animals. The TD50 is the toxic dose for 50 percent of the animals tested. The
443 larger the TD the more poison it takes to produce signs of toxicity. The toxic dose does not give any
444 information about the lethal dose because toxic effects (for example, nausea and vomiting) may not be
445 directly related to the way that the chemical causes death. The toxicity of a chemical is an inherent
446 property of the chemical itself. It is also true that chemicals can cause different types of toxic effects, at
447 different dose levels, depending on the animal species tested. For this reason, when using the toxic dose
448 designation it is useful to precisely define the type of toxicity measured, the animal species tested, and
449 the dose and route of administration.

450 Returning to CAOPLC's analogy of the 170 mph Ferrari after this brief explanation of toxicology, it seems
451 evident that both time weighted exposure and maximum dosage levels are both critical to
452 understanding the possible harmful and lethal effects of EMF radiation.

453
454 And yet it is still difficult to isolate out and remove any micro and macro environmental effects from an
455 analysis of EMF's. Returning to the Children with Leukaemia Foundation study, on page 8 there is a
456 table of other positive causative factors in childhood leukemia such as exposures to pesticides and
457 herbicides (CL&P does apply herbicides to maintain the ROW), to having smokers as parents, diet and
458 possible genetic mutations.
459

460 ***Gene Mutations and Childhood Leukemia Risk***

461
462 And there is this recent discovery reported in a British newspaper, The Daily Mail, which we have
463 attached as Exhibit One. The article reports that a gene mutation in some children quadruples the risk
464 of childhood leukemia and bone marrow cancers for children who live within 333 feet of a high voltage
465 power line. The research showed that one in 20 children have this gene mutation. This offers a
466 possible explanation as to why various animals studies have shown no or minimal response to EMF
467 radiation.
468

469 ***Toxicogenomics***

470 There is also another scientific advance that may help resolve the questions surrounding EMFs and
471 power lines. It is the relatively new scientific discipline of Toxicogenomics.
472

473 Toxicogenomics is the study of the response of the genome to toxic agent exposure; it has been
474 described
475 as 'a tool of unprecedented power' in toxicology [1].
476

477 The term 'Toxicogenomics' in its broadest meaning encompasses profiling of gene expression,
478 protein

Citizens Against Overhead Power line Construction

479 composition (proteomics) and the metabolic constituents (metabonomics) of a cell. A key
480 toxicogenomic technique is to profile (using a DNA microarray or ‘gene chip’) the cell-wide changes
481 in gene expression following exposure to toxins. This approach creates the potential to provide a
482 molecular ‘fingerprint’ of exposure or toxicological response to specific classes of toxic substances
483 [1–3].

484
485 Gene expression changes measured by DNA microarrays can provide a more sensitive and
486 characteristic marker of toxicity than typical toxicological endpoints such as morphological changes,
487 carcinogenicity and reproductive toxicity [4]. Moreover, altered gene expression can occur
488 immediately following exposure, whereas the clinical manifestation of toxicity might take days,
489 months or even years to
490 develop. Initial ‘proof-of-principle’ experiments have successfully identified the category or
491 toxicological
492 mechanism of toxic chemicals on the basis of their gene expression profiles [3,5,6]. The potential
493 promise of this technology is enormous. For example, DNA microarrays could be used to identify or
494 confirm the
495 category of toxic substances to which an individual was exposed, based on gene expression profiling.

496
497 Notwithstanding the tremendous potential of gene expression profiling, many obstacles and
498 uncertainties remain to be resolved before toxicogenomic data should be used outside the research
499 context for practical, regulatory or legal applications [7,8]. The toxicological significance of gene
500 expression changes must be validated, including an evaluation of the robustness of microarray results
501 between or across different laboratories, species, individuals, tissues and time periods [4]. For
502 example, it will be important to understand the time course of gene expression changes following
503 toxic exposures because some alterations might be transient and others might lead to permanent
504 changes.⁸

505
506 Like all new technologies, Toxicogenomics has its advocates who see great promise and its critics who
507 while recognizing the promise of Toxicogenomics have questions relating to its role in policy making
508 decisions in environmental law and possible concerns of its ability to accurately isolate cause and effect
509 relations in heterogeneous populations.⁹

510
511 And NU/CL&P’s stance, offered to us in our “community outreach meetings” was that CL&P has no legal
512 responsibility and are insulated from wrongful death claims from EMF’s because CL&P “follows the
513 standards and practice of current power line construction techniques.” This clearly is not a model of
514 corporate responsibility or good citizenship. And it clearly seems to fly in the face of recent research.

515
516 In CAOPLC’s opinion, overhead transmission lines while they may arguably be initially less expensive to
517 construct, especially from the perspective of CL&P’s balance sheet, they are a false and very risky
518 economy. A Pennywise and Pound foolish choice as it were.

519
520 **And we are asked by CL&P’s insistence on HVAC technology and high voltage overhead lines to trade**
521 **our health and safety against the visual pollution of 10 to 13 story high power towers. That is an easy**

⁸ Toxicogenomics and toxic torts, Gary E. Marchant, Web: <http://www.law.asu.edu/files/Programs/Sci-Tech/Commentaries/trends.marchant.pdf>

⁹ The False Promise Of The Genomics Revolution For Environmental Law, *David E. Adelman**
http://www.law.harvard.edu/students/orgs/elr/vol29_1/adelman.pdf

Citizens Against Overhead Power line Construction

522 choice, our health and our children's' health and safety is much more important. If high towers
523 reduce EMF fields and given the time residents and children spend in the ROW, the higher the towers
524 the better if that is our only choice.

525
526 If there only was a safe and more environmentally responsible way to construct the transmission line to
527 meet CL&P's stated need for reliable electricity but one without all of the possible health, safety and
528 visual impacts of a row of large overhead towers. And CAOLPC believes there is: HVDC power lines.

529

530 HVDC Technology – Background Information, Technical Applications and Costs

531

532 The text below is excerpted from: Connecticut Siting Council -- Investigation into the Life Cycle Costs of
533 Electric Transmission Lines, 2007. (Underlining is for emphasis and to note CAOLPC's discussion points.)

534

535 " 5.3.2 HVDC Typical Costs

536 High voltage direct current transmission systems involve the conversion of alternating current power to
537 direct current for the purpose of transmitting the power over long distances, typically hundreds of miles.
538 Shorter applications are also feasible depending upon the specific requirements. A recent example in
539 the Connecticut is the Cross Sound cable, a 40 km, 330 MW, ±150 kV HVDC cable connecting
540 Connecticut with Long Island, New York. The (Cross Sound) cable connects the 345 kV transmission
541 system at New Haven to the 138 kV system at Shoreham Generating Station on Long Island.

542

543 HVDC is used for special purposes such as, connecting AC systems of different system strengths or
544 frequencies, and for connecting remote hydro or wind power interconnections to the grid. HVDC has the
545 following characteristic benefits:

546

- 547 • Controllable – power injected where needed
- 548 • Higher power over the same right of way, thus fewer lines
- 549 • Bypassing congested circuits – no inadvertent flow
- 550 • Reactive power demand limited to terminals
- 551 • Less losses over long distances

552 Each potential application of HVDC must be evaluated in comparison to an AC circuit to meet the same
553 need. HVAC and HVDC are not equal technical alternatives. **For overhead applications, long distance,**
554 **point-to-point power transfers are an application where HVDC may be the only reasonable**
555 **alternative. For underground or submarine applications the high capacitance and the resulting costs,**
556 **create the possibility for HVDC to be cost competitive and operationally preferred to an AC circuit.**
557 **The Cross Sound cable is an example.** The high cost of terminal converter stations required for HVDC
558 often offset any potential savings compared to an AC line.

559

560 Only long distance applications tend to overcome this cost addition. Distances required to reach a break
561 even comparison between AC and HVDC vary widely with underground and overhead
562 applications, but generally underground (or submarine) distances of 30 miles are required while the
563 overhead distance required for feasibility may be ten times as much¹⁰. (See footnote 10)

¹⁰ If instead of looking at the GSRP as having a stand-alone Connecticut component and having a stand-alone Massachusetts component, since it is all NU subsidiary companies constructing the

Citizens Against Overhead Power line Construction

564
565 HVDC must also be considered in the context of being a component of a larger AC system. The
566 compatibility of the systems, the locations and land requirements for converter stations, future load
567 growth, long term maintenance costs and many other considerations must be taken into account when
568 considering an HVDC application. These are all critical elements of a life-cycle cost analysis that
569 compares HVDC and HVAC for each specific situation. Some examples of installed cost of two terminal
570 HVDC systems are shown in Table 5-4. (This includes the terminals only, not the line itself.)

571
572 **Table 5-4 HVDC Typical Costs**

573
574

2 Terminal HVDC Typical Costs	
Transmission System Capacity Installed Cost (millions of dollars)	
575	
576	
577	200 MW \$40 - \$50 500 MW \$75 - \$100
578	1000 MW \$120 - \$170 2000 MW \$200 - \$300

579
580 The potential use of HVDC transmission as an alternative to the proposed Middletown to Norwalk HVAC
581 transmission project was studied and debated in detail during the Docket 272 proceedings in 2004.

582
583 The end result was that HVDC lines were rejected as a viable alternative for the proposed AC line. The
584 reasons for rejecting HVDC were:

- 585
- 586 1. The risk of introducing harmonics into the system associated with *classical HVDC solutions*.¹¹
 - 587
588 2. Increased complexity in the control and operation of HVDC systems...due to the scheduling of
589 power.¹²
 - 590
591 3. The likelihood that an HVDC "...solution may preclude any additional generation from ever being
592 installed between Beseck and Norwalk due to the additional costs of 100 to 150 million dollars for
593 each generator connection and the difficulty in recovering these high costs". (Tr. 7/29/04, p. 139).¹³

project it should be viewed as a single project. C17 will not consider HVDC for the CT portion because it is only a few miles. Changing a CL&P hat to a WMECO hat when the GSRP crosses the Suffield - Agawam border, should not be allowed to disadvantage the economics of HVDC technology, especially when weighed against all the health, social, local and citizen economic benefits and the preservation of the Metacomet trail.

Additionally, the NEEWS CCRP project directly connects to the GSRP. The is one long 345 kV power line running from Ludlow, MA to the Watertown, CT area. It should be treated as such especially if favorable engineering solutions are being overlooked because of CL&P's arbitrary parsing of the power transmission project into arbitrary components. The same hold true for the NEEWS Intestate Reliability project. When considered together the NEEWS project are roughly 150 miles of transmission lines at a projected cost of \$2.4 billion.

¹¹ CAOPLC *Emphasis added*. See Addendum Materials, page 35 of docket 370 ABB HVDC engineering document which was commissioned by CL&P. ABB has solution for harmonics.

¹² See Addendum Materials.

Citizens Against Overhead Power line Construction

594
595 In this case, the additional costs for each generator connection are those associated with building an
596 additional HVDC terminal. Many other aspects of embedding an HVDC line were also discussed during
597 the Docket 272 hearings.

598
599 These and the above-mentioned factors make it unlikely that either an overhead or underground HVDC
600 line will be installed within the State of Connecticut as a direct alternative to an HVAC line. Therefore,
601 the life cycle costs of such lines are not addressed in this report.”¹⁴

602 **Notes and commentary on HVDC technology.**

- 603
- 604 • It appears from the highlighted text that the CSC only examined the “HVDC Classic” technology.
 - 605
 - 606 • There are two well established types of HVDC technology, (1) “HVDC Classic” and (2) “HVDC
607 Light”.
 - 608
 - 609 • We believe the CSC’s conclusion that “it unlikely that either an overhead or underground HVDC
610 line will be installed within the State of Connecticut as a direct alternative to an HVAC line” is
611 now incorrect and potentially prejudicial to docket 370 unless it is reexamined and updated to
612 address the HVDC Light technology.

613
614 This below excerpted material is from the web site of the Swiss electronics giant, ABB, who developed
615 the HVDC Light technology. Much the same information can also be found on the web site of Siemens,
616 ABB’s German counterpart.

617
618 Any search of HVDC Light installations will find that the vast majority of the world has embraced the
619 technology and that there are numerous successful installations of HVDC Light technology.

620 **HVDC Light¹⁵**

621 "HVDC Light is the most interesting power transmission system developed for several decades"

622 HVDC Light[®] is a state-of-the-art power system designed to transmit power underground and
623 under water, also over long distances. It offers numerous environmental benefits, including
624 “invisible” power lines, neutral electromagnetic fields, oil-free cables and compact converter
625 stations.

626 HVDC Light[®] increases the reliability of power grids, and the technology extends the economical
627 power range of HVDC transmission down to just a few tens of Megawatts (MW). In the upper
628 range, the technology now reaches 1,200 MW and ±320 kV.

629

¹³ Also see Addendum. ABB offered a solution for installing new generation facilities.

¹⁴ **Given the commentary in this section, and given the recent advances in HVDC technology, this conclusion unless reexamined, may be prejudicial and if relied upon as a precedent may prevent the consideration and application of beneficial and cost effective technology.**

¹⁵ Source: <http://www.abb.com/industries/us/9AAC30300394.aspx>

Citizens Against Overhead Power line Construction

630 It is quick to install and provides an alternative to conventional AC transmission systems and
631 local generation. Possible applications include:

- 632 • Connecting wind farms to power grids
- 633 • Underground power links
- 634 • Providing shore power supplies to islands and offshore oil & gas platforms
- 635 • Connecting asynchronous grids
- 636 • City centre in-feed

637 **Utilities are under extreme pressure to meet consumer and regulatory demands for a high**
638 **quality, competitively priced power supply that has low environmental impact. The expansion**
639 **of AC transmission capacity is often limited by local planning regulations and the concerns of**
640 **local residents who object to the installation of new overhead lines.**

641
642 **It is now economically feasible to expand transmission capacity using underground HVDC**
643 **cables. This approach not only minimizes environmental impact, it also improves the quality**
644 **of the power supply.**

645
646 HVDC Light[®] was introduced in 1997. A number of underground transmissions up to 350 MW are
647 in commercial operation and more are being built.

648 ***Applications of HVDC Light***

649 HVDC Light is an alternative to conventional AC transmission or local generation in many
650 situations.

651 HVDC Light[®] has important advantages, such as underground cables instead of overhead lines,
652 short delivery times, **compact stations**, controllability of power and voltages, possibility for
653 multi-terminal operation, etc.

654 **The fact that it is possible to build a long electric power transmission underground and avoid**
655 **public opposition and long uncertain approval processes, makes the HVDC Light system very**
656 **attractive.**

657 From only this brief introduction, it appears clear that we would be remiss especially considering CL&P's
658 proposed investment of \$700 million dollars in the GSRP and \$2.4 billion in NEEWS to not to fully and
659 independently investigate this technology.

660
661 **One of CAOPLC's key goals to have the CSC and/or MA EFSB approve retaining an independent**
662 **engineering firm such as KEMA to study:**

663
664 **(1) if it would be technically feasible, cost effective and appropriate to use HVDC Light technology in**
665 **CL&P existing design for the GSRP,**

666
667 **(2) if it is not technically feasible, cost effective and appropriate could similar reliability objectives be**
668 **achieved with a different design that does use HVDC Light technology and,**

669

Citizens Against Overhead Power line Construction

670 **(3) if so, prepare a comparative study of HDVC Light underground cable vs. 345 kV HVAC XLPE**
671 **underground cable and 345 kV HVAC ACSR overhead cables for the entire group NEEWS projects.**
672

673 ***Other compelling and important HVDC documents for CSC and MA EFSB review:***

674
675 (1) This is a PowerPoint presentation given by Jeffrey A. Donahue, President and CEO of a HydroQuebec
676 subsidiary company, TransEnergieUS, at the FERC Technical Conference, Hartford, Connecticut,
677 October 13, 2004 on HVDC. It includes a number of photographs on how simply HVDC cable is
678 installed using Australia's Murrylink project as an example.

679
680 This presentation is one of the best overviews of HVDC that we have found:

681
682 <http://www.ferc.gov/eventcalendar/Files/20041026155240-Donahue,%20Trans%C3%89nergie.pdf>
683

684 (2) This next document is ABB's engineering proposal for Docket 272 Middletown to Norwalk that
685 confirmed the HVDC Light met every technical consideration set forth by NU's engineering staff and
686 ISO-NE, that there are a number of successful worldwide installations (page 40) and that the
687 proposed construction and installation costs (page 39) are comparable to CL&P's HVAC
688 overhead/underground solution that was constructed for the Middletown to Norwalk segment:

689
690 http://www.ct.gov/csc/lib/csc/docket_272/nh1-493072-v1-abb_technical_description.pdf
691

692 (3) This reference is for ABB's technical study for docket 272 Middletown to Norwalk that confirmed the
693 HVDC Light met every technical consideration set forth by NU's engineering staff and ISO-NE.

694
695 http://www.ct.gov/csc/lib/csc/docket_272/nh1-493071-v1-abb_underground_hvdc_feasibility_study_report.pdf
696

697 (4) And the last reference paper we would ask that OCC review, is a brief but very well done summary
698 of the benefits of HVDC and its applications from Prof. L. A. Koshcheev, St-Petersburg, High Voltage
699 Direct Current Power Transmission Research Institute. This paper was prepared for the Third
700 Workshop on Power Grid Interconnection in Northeast Asia, Vladivostok, Russia, September 30 -
701 October 3, 2003.

702
703 This paper is written in mostly layperson's terms and addresses HVAC health issues and on pages 7
704 and 8 discussed land use costs and how HVDC improves the economics of siting power lines in right
705 of ways. Visual impacts are addressed on page 8.

706
707 As an editorial comment, it is surprising to CAOPLC that a Russian government and its sponsored HVDC
708 research agency are much more progressive and ecologically oriented than is NU and CL&P in its stance
709 towards the benefits of HVDC technology:

710
711 http://www.nautilus.org/archives/energy/grid/2003Workshop/Koshcheev_paper_final1.pdf
712

713 In CAOPLC's research efforts, we have found that there is a growing consensus of opinions that HDVC
714 will become a more dominant technology and that HVAC, while the preferred solution for the past
715 century, will go the way of the buggy whip for the backbone of our national power grid. One startling

Citizens Against Overhead Power line Construction

716 fact is that solely in the generation and transmission of electric power, the USA loses enough electricity
717 to power all of Japan.¹⁶

718 ***HVDC and Renewable Energy***

719
720 Although there is a great deal of discussion about the need to harness renewable energy to help in both
721 replacing the carbon-based fuel sources currently used in power generation and to lessen our
722 dependence on foreign oil, there has been less discussion regarding the need to build a new
723 infrastructure to convey that power. HVDC is the superior technology for renewable energy
724 transmission.

725
726 The current electrical infrastructure is designed to move power from coal-fired power plants, natural gas
727 fired generators (and a few nuclear plants) to large cities. The possible size of new solar and wind energy
728 farms in California, the southwest and upper Midwest and wind farms throughout the New England
729 coast easily swamps the ability of existing transmission lines to carry that power. By some estimates the
730 amount of power that needs to be moved from anticipated solar and wind farms exceeds the existing
731 infrastructure by a factor of four on any given route. This means that it will be necessary for some entity
732 to undertake what could easily be described as the biggest regional infrastructure project since the
733 Interstate system.

734
735 There are only two ways to convey this new source of renewable energy and they are the same two
736 methods debated by Thomas Edison and Nicolai Tesla in the 1800s: direct current (Edison's choice) and
737 alternating current (Tesla's choice). Although Tesla won the argument and alternating current became
738 the exclusive means by which utilities move electricity in the United States, High Voltage Direct Current
739 ("HVDC") lines offer several advantages over AC for the transmission of wind energy over long distances.

- 740
- 741 1. For long-distance distribution of electrical power, HVDC systems can be more efficient. As
742 electricity is transmitted via an alternating current line, because of the constant cycling of the
743 three phase power part of the transmitted energy transforms into heat and is wasted. HVDC
744 systems suffer significantly lower thermal losses than the commonly used alternative current
745 systems.
 - 746
747 2. HVDC can carry much more power per conductor. This can be a substantial advantage when
748 using a narrow right of way for a utility easement, as more power can be carried on each line.
749 This also decreases the need for a wider tower array to carry the power.
 - 750
751 3. HVDC lines can be placed closer together as they are not as susceptible to electrical harmonic
752 interference. This is another feature of HVDC that works well with a narrower right of way.
 - 753
754 4. Narrow right of way. The large AC projects currently in development may need in excess of 250
755 feet in width in order to build the large towers needed to support HVAC. Existing laws may not
756 support that extra width. By utilizing HVDC, it may be possible to avoid the larger footprint
757 needed for the tower structures. Instead of H-frame towers, HVDC can use single large steel
758 pole structures.
- 759

¹⁶ Michael Grunwald, Time Magazine, January 12, 2009 on Energy Efficiency and Conservation.

Citizens Against Overhead Power line Construction

760 There are a few disadvantages of HVDC systems that have been documented:

761

762 1. High cost of conversion. The main disadvantage of HVDC is the high cost of converting DC to AC.
763 Therefore, it is anticipated that a HVDC utility line will have a limited number of converter
764 stations, perhaps as few as two, one on each end of the line. For the transmission of renewable
765 energy, this may not be a major disadvantage as the market for electrical power tends to be in
766 areas that do not generate significant amounts of wind energy.

767

768 2. Lack of existing knowledge and infrastructure. Long-distance HVDC systems have not been widely
769 used in the Americas.

770

771 However, a number of companies have announced intentions to use HVDC for electrical transmission
772 lines, including the Titan project, which is a joint venture between Clipper Windpower and BP
773 Alternative Energy for the transmission of wind energy from South Dakota to Chicago and several
774 projects to deliver hydroelectric from Canada to New England and wind energy from Maine to Boston.
775 Siemens is currently constructing a 5,000 megawatt (at 800 kilovolts) line in the Guangdong province in
776 southern China. HVDC is widely used in Europe in undersea cables and is used by utilities to balance
777 loads from disparate AC systems.¹⁷

778

779 In New England, there is the 450 kV DC facility terminating at Sandy Pond. National Grid USA operates
780 the New England portion of two interconnections know as Phase 1 and Phase 2, between New England
781 and Canada. Sandy Pond is a + 450 kV DC 2000 MW bipolar converter terminal located in Ayer, MA.

782

783 HVDC Connection between James Bay and Sandy Pond

784



785

786

787 As legislative mandates for ever increasing amounts of renewable energy come into play, for example, in
788 Connecticut there is a mandate to have at least 20% of the electricity to come from renewable sources
789 there will be a growing demand for renewable energy power. If that metric is not achieved, there is a

Citizens Against Overhead Power line Construction

790 penalty, an Alternative Compliance Payment that goes to the CT Clean Energy Fund. The fund will then
791 invest the money into renewable projects.

792
793 Both Connecticut Utilities, UI and CL&P have produced a study that predicts the renewable energy
794 penalties could reach \$200 million by 2011 and \$320 by 2020. The costs are incorporated into the rates
795 consumers pay for electricity. The CT Clean Energy Fund paints a more rosy picture saying that there are
796 enough renewable energy projects to meet the regional demand.¹⁸

797
798 No matter which prediction plays out, CAOPLC there is a compelling need to investigate the use of HVDC
799 technology. It provides the far greater environmental benefit. It will most likely be a technology with a
800 more productive and longer life cycle. It is less susceptible to outage from wind, ice and weather related
801 causes. Studies in North Carolina showed an outage rate of 50% less. Studies conducted by the
802 Australian government showed a outage rate of 80% less than HVAC overhead lines.¹⁹

803
804 HVDC is easier and quicker to install with simple cut and cover trenches. It required only plastic splices
805 and not the huge concrete vaults of HVAC. It does not have the technical limitations of HVAC
806 underground lines.

807
808 And when right of way costs and land acquisitions are considered, HVDC is a clear winner. On the
809 Newgate right of way, CL&P has said that one more HVAC line can be installed in the right of way before
810 more land is needed. In the more narrow Massachusetts right of way, the situation is even more
811 problematic. HVDC solves that concern.

812
813 As we mentioned in previous testimony, CL&P has a fiduciary duty to its institutional shareholders. That
814 may be why this was written in the CSC summary report by the CT Woodland Coalition to its members
815 on how CL&P responded to a two engineering studies from ABB, the company that invented HVDC Light
816 technology, on its finding that the entire Middletown to Norwalk project could be constructed
817 underground and at a potential savings of over \$200 million to what CL&P actually spent to construct
818 the transmission line:

819
820 **Wednesday, December 15, 2004** ²⁰
821 **Evidentiary Hearings** (emphasis underlining and bolding is by CAOPLC)

822
823
824 Today opened with brief statements by four chief elected officials from municipalities along
825 the Phase Two line. All felt that the Siting Council should take more time and be allotted
826 more funds to evaluate undergrounding more thoroughly, per the state legislation in favor
827 of undergrounding.

828 The major testimony of the day concerned the ABB Report. It offers a high-voltage direct
829 current (HVDC) alternative to the proposed Phase Two, which transmits high-voltage
830 alternating current (HVAC). Witnesses elaborated on the three options presented in the
831 ABB Report, all of which involve undergrounding most of the way from Norwalk to

¹⁸ Hartford Advocate September 11, 2008

¹⁹ FERC Technical Conference, Hartford, Connecticut, October 13, 2004, Jeffrey A. Donahue, Hydro Quebec

²⁰ http://woodlandscoalition.com/HearingUpdates.htm#_ftn1

Citizens Against Overhead Power line Construction

832 Middletown. According to ABB, the HVDC approach solves the reliability problems ISO-
833 NE has found in the proposed Phase Two.

834 **1. ABB. During early Siting Council hearings, it became evident that HVDC could be put**
835 **underground reliably for longer distances than HVAC, and the Siting Council directed**
836 **NU to follow up on this possibility: NU then hired ABB.** As a worldwide company that is
837 a leader in HVDC technology, ABB did feasibility studies to see if HVDC underground
838 could meet the Applicant's specifications for Phase Two.

839 **2. The ABB Report.** HVDC transmission is a fundamentally different type of electrical
840 system than HVAC. It offers few problems with undergrounding; instead, the main problem
841 ABB needed to analyze was the feasibility of embedding a SWCT HVDC line in a system
842 that is otherwise HVAC. They came up with three feasible options, all involving different
843 combinations of new converter stations and other equipment to manage the integration.
844 One feature of their study was that it covered only Norwalk to Beseck (a substation in
845 Wallingford), and not the entire length of the line from Norwalk to Middletown. This was
846 per order of the Applicants.

847 **3. Discussion of the ABB Report.** **Much of the cross examination by the Applicant's and**
848 **ISO of ABB was contentious, the cross serving to challenge the very company hired by**
849 **the Applicants. ABB was questioned closely about reliability in regards to a DC segment**
850 **in the middle of an AC line. Questions were raised about expandability, what happens**
851 **when there is new generation, for example. PSE&G, a generating company, also**
852 **participated in the cross of ABB, also not in a supportive questioning. The attorneys**
853 **representing the municipalities pressed, in their cross, ABB to know if an HVDC line**
854 **could be extended the whole length of the proposed route from Norwalk to Middletown,**
855 **and ABB was unable to give them that assurance, stating they hadn't been contracted to**
856 **study the whole route²¹.** The cost of an HVDC alternative is clearly an issue, as new
857 converter stations would have to be built from the ground up at certain points, to replace
858 conventional sub-stations, but since ABB had not been contracted to examine costs in any
859 detail, cost comparisons were not a major focus of discussion.

860 **4. Next steps.** At present, the Reliability and Operability Committee (ROC), a group of
861 engineers from the Applicants and ISO-NE, are doing tests, running studies and evaluating
862 all of the major alternatives so far suggested to original Phase Two proposal. The ROC
863 report is due on or about December 20. It's unclear what the ROC report will suggest, or
864 whether its suggestions will focus on an HVDC alternative. Many good questions, yet to be
865 answered, were put on the table regarding the use of DC in this project.

866 CL&P is not impartial and without vested interests. CL&P cannot be relied upon to produce fair and
867 impartial engineering studies for a technology that they for whatever reason do not embrace.
868

²¹ If the proper instruction had been given to ABB by CL&P to follow the mandate of the CSC to investigate the undergrounding of the entire transmission route, CAOPLC wonders how the Middletown project would have turned out. We feel that at a minimum, the CSC should have required ABB to investigate the feasibility of undergrounding the entire route.

Citizens Against Overhead Power line Construction

869 **Therefore, CAOPLC asks that the CSC and/or MA EFSB retain an independent engineering firm to such**
870 **as KEMA to study the feasibility of using HVDC Light or HVDC technology for the GSRP and other**
871 **NEEWS projects.**

872 873 **Visual and Environmental Impacts of the GSRP**

874
875 The visual impacts that cause the most concern for CAOPLC members are those of the proposed towers.
876 The tower height is a trade off between EMF mitigation and Visual Pollution of the overhead towers.

877
878 If one followed the principles of reductio ad absurdum, would anyone agree to run power lines along
879 the top of Mount Rushmore or along the middle of the Washington DC mall or in the middle of the
880 Grand Canyon? Absolutely not. It would be unthinkable to deface such national treasure as these.

881
882 The siting councils have to decide the importance of preserving a National Heritage Trail area. Does the
883 Metacomet trail and Newgate area rise in importance to that of Mount Rushmore? No. Is it a locally
884 and regionally historically significant and beautiful scenic and recreational area, Yes. Beyond these brief
885 comments, lies your deliberations.

886
887 CL&P has used the Truescape simulation technology to try to show how benign the impacts of the GSRP
888 will be. CAPOPLC has a number of issues with the use of Truescape. First it was only done in a "leaves
889 up" season. That is the equivalent in our minds to CL&P having ABB study only a portion of the
890 underground solution and then dismissing their conclusions as incomplete. For a full and balanced view
891 of the visual impacts on this area, a companion simulation should have been done showing the area
892 with the leaves down.

893
894 The area has heavy deciduous trees foliage. CAOPLC will readily concede that when there are leaves on
895 the trees, the present 70 foot tall lattice towers are for the most part adequately hidden. We are not so
896 certain about the much higher 130 foot towers. But when there are no leaves on the trees, our
897 panoramic view is that of power towers.

898
899 Our second issue with Truescape can be succinctly summed up by the testimony and conclusion reached
900 Truescape's expert witness, Mr. Coggan:

901
902 MR. LEGERE: There was -- when you're -- you're looking at the video, it's location

903 7, it's the intersection of Copper Hill and Newgate Road, and in the video it was where it came up to a red

904 stop sign and you saw a 35 mile-an-hour speed limit sign, a couple of towers, the camera pulls back, and --

905 and where you're saying that the Truescape is representative -- video accurate of the area -- I want to ask

906 why the opposite direction -- the views from the -- you're standing north looking south -- if you switched

Citizens Against Overhead Power line Construction

907 your viewpoint and you were south looking north, the Truescape would have shown two houses that are
908 considered fall zone houses ²²where the tower --

909 CHAIRMAN CARUSO: Are they --

910 MR. LEGERE: -- is directly --

911 CHAIRMAN CARUSO: Well, I guess the question is why did you choose going in
912 that direction rather than --

913 MR. LEGERE: Yes --

914 CHAIRMAN CARUSO: -- turning around and seeing it the other way?

915 MR. LEGERE: Yes.

916 CHAIRMAN CARUSO: Okay. Why did you choose the directions in which you
917 showed the simulation?

918 MR. COGGAN: Well, it was a -- it was a collaborative decision between Truescape
919 and Northeast Utilities. It seemed to me to be the most obvious route.

920 And one of the -- one of the reasons was that -- from my perspective when I first
921 drove down there and we dropped that at the clearing on Newgate Road and we looked through, that
922 seemed to give a decent view of the power line. Now one of the things that we always and do is get a
923 synergy with the viewpoints and we try and go and take consistent and -- consistent in the direction that
924 we're traveling. And bear in mind that this is a representative video rather than a drawing upon each
925 individual house. So it's as simple as that. There was no other reason than, you know, it seemed logical for
926 us.

²² A "Fall Zone" house is defined by HUD and FHA as a home situated so close to a power tower that if the tower were to fall, personal injury and property damage would occur. Fall Zone homes are not eligible for FHA financing, thus making them extremely difficult to market and sell without the ability to secure FHA's financing.

Citizens Against Overhead Power line Construction

927 MR. LEGERE: It seemed -- my -- my -- my last question would be **if the viewpoints -**
928 **- if the survey points were different, Truescape would show a different view of the area?**²³

929 MR. FITZGERALD: I think we can stipulate to that.

930 MR. COGGAN: No, because we --

931 MR. FITZGERALD: No, we can't --

932 MR. COGGAN: -- we directed where the -- where the survey points were. So we --
933 we actually -- they weren't known survey points that were in the ground. We had a surveyor go out there
934 and create those points for us on the backbone of the photo point positions that we were using.

935 MR. LEGERE: I think maybe you didn't understand my question, and I think maybe
936 I'm not understanding your answer. But to give it one other try, **if -- if you used entirely different survey**
937 **points -- you used the term directing -- if you directed different survey points at different other points in**
938 **the Newgate area, the video would potentially look different?**

939 MR. COGGAN: Well if we choose to simulate different areas --

940 MR. LEGERE: That's -- that's my --

941 MR. COGGAN: -- **of course it would** --

942 MR. LEGERE: -- that's my question.

943 MR. COGGAN: -- **yes**.

944 MR. LEGERE: Yes, okay. That's it for me.

945 I freely and humbly admit that I do not have the cross examination skills of a courtroom litigator. But if a
946 private citizen in a few minutes of cross examination can determine that the Truescape simulation only
947 shows only what NU, CL&P and WMECO want it to show, it is not a very "truescape" at all. And its use and
948 value in the final siting deliberations of the GSRP's visual impacts must be heavily discounted.

949
950 Equally problematic is a very delicate situation that we came across. We would preface it by saying that
951 CAOPLC does not believe in anything other than a polite and respectful dialogue. We see no value in
952 theatrics or confrontational tactics. Nor in personal or reputational attacks.

²³ Bolding added by CAOPLC for emphasis.

Citizens Against Overhead Power line Construction

953
954 So if we can present this in the most general way possible so that we avoid making it a personal issue and
955 make it a concern that we have about how the construction process will be documented and monitored, we
956 found that one of CL&P's panel of experts ran into legal difficulties for work that was done on a prior energy
957 project. The executives of the firm that this person worked with were indicted by the federal government
958 and eventually pled guilty to civil and criminal charges and paid fines of \$22 million.

959
960 The CL&P panel individual we are referring to was also personally indicted by the federal government but
961 after the settlement was reached with the corporation the district court dismissed the charges. To be fair,
962 the individual was not found to be personally liable.

963
964 Our concern does not relate to innocence or guilt and it is not about professional ability or competence.
965 It is about what assurance do we have that the situation that occurred in this federal lawsuit will not
966 occur on the GSRP? We would be willing to let CL&P address this issue in private before any response is
967 offered. But we do feel it is a valid question to ask and a concern.

968
969 CAOPLC also discussed the issues of water runoff and the right of way clearing on Phelps Road. Our
970 ideal solution is the undergrounding of the power lines and the use of HVDC power lines because the
971 construction process is much less invasive, less land need to be cleared and there is of course the very
972 big benefit that HVDC power lines do not emit EMF radiation.

973

974 **Property Values**

975
976 CAOPLC members have concerns about the visual impacts and the health and safety impact of the
977 power towers on our property values.

978
979 In response to our concerns about the diminution of our property values, CL&P says emphatically that
980 THERE IS NO LOSS OF VALUE FROM THE POWER LINES.

981
982 Interestingly when we ask about rights we have in the easement land, such as to ask that no pesticides
983 be sprayed on our agricultural lands, especially for those properties that practice organic agriculture,
984 CL&P paradoxically says we have no right to control what CL&P does in the right of way land.

985
986 Our property owner's rights to easement land, according to CL&P, were given up when we bought our
987 properties BECAUSE THE EXISTING POWER LINES CAUSED A REDUCTION IN PROPERTY VALUE, a benefit
988 we enjoyed in the form of a reduced price at the time of purchase. That reduction in value balances
989 giving up, apparently as CL&P views it, all of our rights to the land save for paying property taxes on it on
990 behalf of CL&P.

991
992 It goes without saying, other than in CL&P's world view, that it can't work both ways:

- 993
- 994 • There can't be a loss of property value when it is favorable to CL&P;
 - 995
 - 996 • and there cannot be a "no loss of property value" situation when the reverse is true, when it is
997 unfavorable to CL&P.
 - 998

999 There have been numerous academic studies done to try to qualify and quantify the effects of high
1000 voltage power lines on home values. All of the studies use statistical modeling. Because an in depth

Citizens Against Overhead Power line Construction

1001 discussion of statistics and survey techniques are beyond the scope of this testimony, it is accurate to
1002 say any discussion of whether or nor HVOPL (high voltage overhead power lines) is much like a
1003 discussion of EMFs.

1004
1005 There are too many variables to account for such as if in new housing developments whether or not a
1006 developer has increased the lot size or improved the amenities of a home near a power line, or one that
1007 has a view of a transmission tower to help sell it. And whether or not those differences are accounted
1008 for in the data and statistical modeling. Some studies show that power lines do cause diminished
1009 property values to varying degrees and some studies show no loss of value. Pragmatically, it would be
1010 an interesting academic exercise to analyze whether or not a study commissioned by a utility, real estate
1011 developer or anyone else who had a vested interest in not having a loss of value has a strong statistical
1012 correlation with a finding of no loss or diminution of property value from HVOPLs.

1013
1014 There is a much easier way and practical to address and come to conclusions about this situation of
1015 diminished property values. Look at the Summary of Project Outreach Communication that CL&P
1016 entered into the CT CSC docket 370's evidence. There are numerous instances in that document where
1017 either a potential property buyer or a Realtor called CL&P to ask about the GSRP. There is some
1018 evidence that buyers are concerned about power lines as shown in this c logged comment, "Customer
1019 Service referred call to NU. Realtor stated that several have made but then dropped offers on the house
1020 after hearing about requested aerial photos." ²⁴ here was another entry to note that an area resident
1021 bought his own EMF meter to measure the radiation on his property.

1022
1023 The simplest question to ask, is if given the choice between two relatively similar homes in terms of
1024 price, square footage, Scholl districts, amenities and so forth, and one was within a short distance of a
1025 ten or thirteen story metal power transmission pole with 345,000 volts crackling through the power
1026 lines and one was not, which home would you chose for your family?

1027
1028 At what price point, especially if you had read up on the dangers of EMFS would you personally decide it
1029 was worth it to choose that home as a place to raise your family? Would that home be a safe
1030 environment for your children to grow up? Would that home be a safe environment for adults with a
1031 familial history of cancer?

1032
1033 CAOPLC asked this question in our CL&P interrogatories on page 8:

1034
1035 Does CL&P agree or disagree with the following statement, "If a demonstrable loss of property value
1036 occurs to a property owner from CL&P's GSRP overhead power line ROW construction project(s),
1037 that loss of property value constitutes a de facto Eminent Domain taking of property without giving
1038 the ROW resident the benefit of due process and legal representation." Please answer in detail with
1039 a legal justification for your answer.

1040
1041 CL&P answer the other questions in this series on property values and the power line easement but
1042 chose not to offer an answer or an objection to this question. To CAOPLC 's residents CL&P's silence is
1043 all of the information that we need to know.

1044

²⁴ Page 5 of CL&P's Summary of Project Outreach Communications

Citizens Against Overhead Power line Construction

1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088

Final Comments

CAOPLC is in the process of preparing photographs and a video presentation of the Newgate/Metacomet area. It is not yet ready but if CL&P intends to show the Truescape simulation, we ask that we be given an equal opportunity to show the information that Truescape does not.

In closing, we found two quotations that could be applicable to the ultimate result of the GSRP's siting process decision.

The first is from Sir Winston Churchill, "You can always count on Americans to do the right thing - after they've tried everything else."

The second is from Ralph Waldo Emerson, "Do not follow where the path may lead. Go instead where there is no path and leave a trail."

Even though we greatly admire Sir Winston Churchill, we hope that Emerson's words are the one that ring home and that the \$2.4 billion in GSRP/NEEWS money is spent to blaze a path that leads New England towards greater energy independence, greater source of renewable energy and a New England transmission grid infrastructure that keeps pace with what is going on in the rest of the world.

We thank both the CSC and MA EFSB for the opportunity to present our testimony and to give voice to the concerns of the residents who will be affected by the GSRP and the NEEWS projects.

Respectfully submitted,

Citizens Against Overhead Power Line Construction

BY: Richard Legere, Executive Director

CERTIFICATION

I hereby certify that a copy of the foregoing will be mailed, e-mailed and/or hand delivered to all known parties and intervenors of record on the docket 370a service list.

Richard Legere