UTILITY LINE LOCATION ISSUES PAPER - SUMMARY REPORT

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Part I: Overview

Section A: Scope and Mandate

In February 2000, the Public Service Board of the State of Vermont held a technical workshop under Docket 5496 to discuss issues related to electric distribution line extensions. As the session report for that hearing summarized:

At the scoping session, the parties heard more detail about and discussed the DPS (Department of Public Service) proposal on the process to be followed in this investigation to address the public policy implications of utility line extensions and relocations. The parties agreed that the DPS would further define its proposal in a post-session recommendation. Subsequently, in its filing, the DPS suggested that the process should begin by retaining an expert on land use and development issues, including both social and environmental aspects, to prepare a fairly limited introductory analysis. This analysis would not require extensive utility engineering expertise because the utilities can supply this assistance to the expert as needed. The expert would prepare an introductory paper that would identify the issues that should be considered in developing policy regarding off-road line locations, underground construction, and land use and related implications.

The paper would explain those issues in sufficient detail to be used by the parties for their recommendations and by the Board for its decision. The paper would also present substantive policy options that the parties and the Board could consider with an explanation of the strengths and weaknesses of those options. Finally, the paper would contain a process recommendation that the Board and parties should follow to reach a final decision on line extension policy.

In June 2001, DPS issued an RFP for development of this introductory paper under Docket 5496. SE GROUP responded with a proposal and through subsequent discussions and coordination with the Department formulated a scope of work that addressed the guidelines of the technical workshop. To enhance this effort, TJ Boyle & Associates was retained as a subcontractor to the process to provide expertise on aesthetic and land use issues. The Department approved the final scope and contract in late October 2001.

The purpose of this summary report is to present information on potential aesthetics and land use impacts of line extensions and discuss the issues that should be considered when formulating a final line extension policy including off-road line locations and undergrounding. In addition, policy options as well as a description of the process for movement towards adoption of policy will also be prepared.

In December 2001, the Project Team held an open workshop to discuss the project with the Steering Committee, invited utility and governmental representatives and others. The workshop was attended by over 40 representatives of the major stakeholder groups. The purpose was to introduce the consultants, present the scope of work and discuss the basic issues facing utility line extensions. Comments from the workshop are summarized in Table 1 on the following pages.

Table 1: Summary of Issues and Comments from Workshop #1 – December 2001	
ISSUES	**COMMENTS**
Transmission vs. distribution issues	▪ Several comments related to whether or not the study would specifically address the issue of transmission line location policy were noted. ▪ The DPS reviewed the issue against the Board's mandate and concluded during the workshop that the scope of the project will not specifically address transmission lines.
Secondary development from line extensions (i.e. growth)	▪ There were several comments regarding the impact of utility line extensions as a result of cell tower installations in rural mountain areas. Representatives of the NVDA indicated that this issue is of some concern as new infrastructure is created in relatively rural areas. The bigger issue appears to be the impact of secondary growth as a result of extension policies and how to assess the costs of this growth. ▪ Some discussion was noted on the issue of how one individual extension request for an extension is handled versus new larger developments. The issue appears to be that the extension and line modification process and any potential impacts can be instigated by a single customer request. In the model of the utility being a service business, an individual customer is very important.
Operational / maintenance issues	▪ The issue of joint trenching was mentioned. The consultants were asked how they would address this issue in the study. ▪ Several comments were made regarding the need to understand the balance between reliability of lines and tree exposure. Many stated that off-road lines are very difficult to maintain. Some like Vermont Electric Cooperative described how their current network of lines is the results of RES policies and a low number of connections per mile. Relocation to on-road areas is the general practice for most. ▪ Some utility service providers related how on long cross-country lines with higher voltages, they cannot climb poles. This creates considerable difficulty for maintenance and access ▪ The issue of customer satisfaction also was discussed. Several participants noted that on recent line extension or hookups, the new lines provide a higher degree of reliability. It was stated that people don't mind the changes once they don't have problems with their power. ▪ Several utility participants expressed concern that day-to-day operational issues would not be considered adequately. A suggestion was made to arrange for field visits with operators to gain a better impression of line location issues. ▪ The issue of equipment cutovers was discussed at some length. The problem, according to some, is that there appears to be a long delay between construction of new structures and elimination of the old structures. Several slides described by the consultants brought this issue forward. The question about the barriers to speedier conversion was raised.
Consolidation of Poles and Utility Lines	▪ Considerable discussion was noted on how non-electric utility infrastructure is driving new line extension or relocations. ▪ Sometimes the issue of complying with modern standards requires changes in design (increased height, new insulators, etc). ▪ The comment was made that utilities had tended to build by themselves in the past. This has resulted in two sets of poles in some cases. ▪ Adjacent service areas can result in multiple utility lines in the same areas. ▪ Some utilities commented that they are working mutually to consolidate poles. It was suggested that the study should consider a policy on consolidation.

Table 1: Summary of Issues and Comments from Workshop #1 – December 2001	
ISSUES	**COMMENTS**
Level of Public Scrutiny	▪ The level of scrutiny was discussed in detail. One comment noted was that "it takes more effort to permit a porch than to get an extension". ▪ Several attendees noted that it is the communities that set the standards for review. ▪ If historic areas are of concern their needs to be a good definition of aesthetic and historic area and "recognized thresholds". ▪ The comment "its not historic issues, its aesthetic issues" was noted. ▪ The Agency of Transportation representative stated that they review new line work within public rights-of-way.
Planning and Land Use Context	▪ Several comments were made regarding how power lines along a roadway can create a visual context for other projects. This issue appears to be the degree to which cumulative changes will impact the visual environment. The consultants should address this issue. ▪ The road right-of-way is a limited resource. With the advent of new technologies and new users, this gets even more limited. ▪ The safety considerations of roadside utility lines and poles were raised. Some asked what studies were available. The VAOT representative stated that they do review these issues in the rights-of-way. ▪ Several comments were heard describing the process by which utilities interact with local towns on planning for infrastructure. Some described a situation where there is little contact. Planning for future subdivision potential was also discussed. ▪ A list of planning and environmental issues was offered that most commonly occur on projects – wetlands, loss of development rights on agricultural lands, anti-growth issues.
Costs	▪ The costs of delivering the new service are borne by the person or group requesting the service. The industry is a service business and must provide service if so requested. ▪ The costs of maintenance are "spread out" system wide. The utilities operate under the "least cost / initial cost" model. ▪ A comment was made that "the utilities are measured on the ability to serve". ▪ A large cost of projects is securing the rights-of-way or easements. One customer can cause significant delays or difficulties. Guying requires securing of easements and increases costs. ▪ Several utility providers indicated that below grade installation could cost 3 to 15 times the cost of aboveground installation. The numbers vary widely based upon the site. ▪ Distance drives the design. The utilities must be able to get access to the line from the driveway or access road year round. ▪ The issue of who really "pays" for extensions was included. Some indicated, "society pays" in some ways. These costs need to be considered in the analysis of this issue
Study Methods and Approach	▪ The consultant team was asked not to just focus on the most contentious projects for case studies. These tend to blow some things out of proportion. ▪ The Steering Group wants to be involved after a more complete analysis of the issues is completed. ▪ The issue of how to assess costs was raised. The consultants need to provide more detail on how costs will be derived.

In addition to outlining the major issues of focus for this study, the workshop also provided some specific parameters on which to evaluate the line location issues:

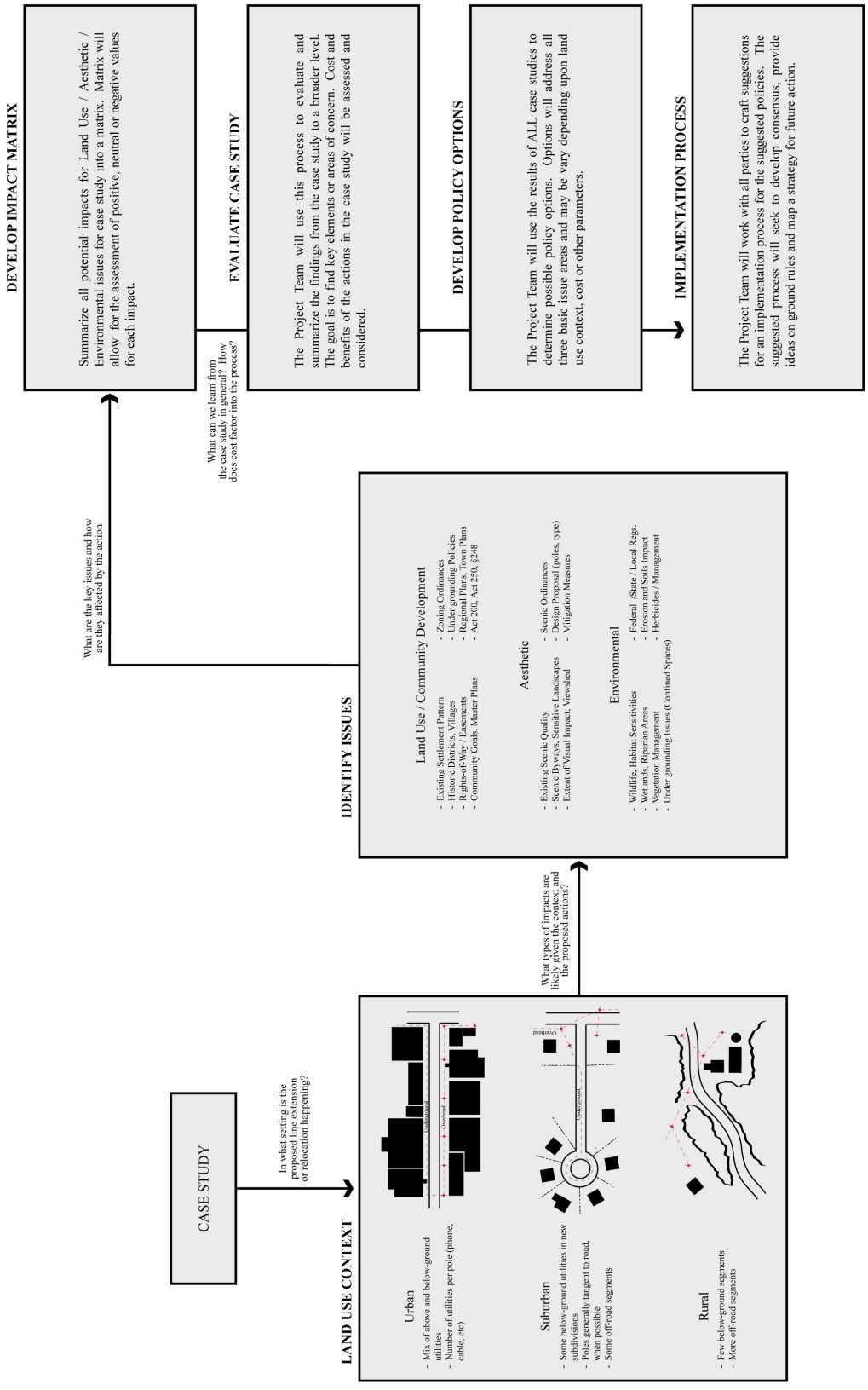
- The scope of the work would address distribution lines only. No consideration to the issues surrounding transmission lines should be included in the analysis.

- The consultants were asked to provide insight and recommendations on aesthetic, land use and environmental issues. The Steering Committee would be a resource through which utility operational issues could be addressed. The costs and impacts of line extensions also needed to be addressed by the consultants.

- Line extensions for this project would include electric distribution lines that were either relocated (including off-road to on-road), upgraded (taller poles, new wires) or extended into an area where they were not originally present.

The project would use a combination of interviews, consultations with utilities and other stakeholders, review of case studies and literature research to conduct the study. The basic methodology is outlined on Figure 1.

Figure 1 – Project Methodology



Section B: Existing Regulatory Issues and Requirements

Utility line relocations and extensions are presently regulated and guided under a variety of programs and policies scattered around Vermont State government. Overall regulation of the industry clearly rests with the Public Service Board (PSB), but individual requests for extensions, depending on context, can ultimately involve a wide array of State agencies and departments. The major regulatory policies, rules, goals and regulations under which distribution line extensions can be reviewed are:

Public Service Board and Statutory Policy

As described under Docket #5496, it is the general policy of the PSB to require that all customers requesting line extensions bear the full cost, less service drop credits. This policy has been enacted in all utility extension tariffs and is fundamental to how costs are recovered. It also clearly places then burden of costs on those seeking fulfillment of service.

30 V.S.A. 218c(b)
This statute sets forth several policies regarding "least cost integrated planning". These provisions require that regulated electric utilities "plan for meeting the public's need for energy services, after safety concerns are addressed, at the lowest present value life cycle cost, including environmental and economic costs, through a strategy combining investments and expenditures on energy supply, transmission and distribution capacity, transmission and distribution efficiency, and comprehensive energy efficiency programs."

In general terms, the role of the PSB's policy has been to promote economic equity between ratepayers and regulated utilities.

PSB Rule 3.631
This rule of the Public Service Board (Effective: 11/7/88 Reviewed: 1/1/92), specifies that each utility is to prepare a long-term vegetative management plan. The rule specifically calls upon each utility to provide information on tree clearing and maintenance operations, establishment of standard practices for interactions with wetlands, wildlife and erosion control and for aesthetic considerations. The requirements of this rule can be waived if a utility demonstrates to the PSB and DPS that its operations are generally free of vegetative cover (open or urban) or that such a plan is not needed.

Vermont Environmental Board (Rule 2A, Rule 70)

Rules 2A and 70 of the Vermont Environmental Board (as amended 1/18/01) set forth the definition and requirements for subsequent review of any line extension project under Act 250. It is through the Act 250 process where significant review of distribution line extensions occurs.

The key points of Environmental Board Rule 2A(12) include:

"Development" subject to Act 250 review is based on several spatial parameters:

- 10 acres of involved lands (the cleared zone) based on a minimum width of 20 feet in towns with zoning and subdivision bylaws (Rule 2A(12)). Based on this calculation, line extensions (with 20

foot rights-of-way) of just over 4 miles would require Act 250 review. Projects completed by municipally-owned utilities are also subject to this provision.

- 1 acre of involved lands within towns without zoning or subdivision bylaws (Rule 2A(12)). This sets the trigger for Act 250 review to 2,200 feet of line extension.

- In cases where rights-of-way are larger than the 20-foot assumed, the actual acreage shall be calculated by multiplying the total aggregate length of the line for the project by the area of actual disturbance.

- "Substantial change" triggering Act 250 review includes increasing pole or structure heights by ten or more feet as measured above the ground (Rule 2A((12a)iii)). The rules do permit other factors to trigger substantial change.

- New corridors include "(A) a corridor for which construction of improvements is proposed outside of any existing corridor, and (B) an existing corridor, if improvements to be constructed or reconstructed will constitute a substantial change."(Rule 2A(12a)(i))

- Underground line extensions are not subject to inclusion within the acreage calculation provided they are not "located above the elevation of 2,500 feet; and no portion of the underground line or facility is located in a rare or irreplaceable natural area, or land which is or contains a natural resource referred to in 10 V.S.A., § 6086(a)(1)(E) (Streams), (1)(F) (Shorelines), (1)(G) (Class I or II Wetlands), (8)(A) (Necessary Wildlife Habitat Or Endangered Species), or (9)(B) (Primary Agricultural Soils)."(Rule 2A(12a)(iv)) The exception to this is in instances where the undergrounding occurs on areas designed as "scenic" by the State of Vermont or in local or regional plans (EBR 2(A)(12)(a)(vi). In this situation, if clearing is associated with undergrounding of the line, the acreage of this portion of line must be included in the total area of "development".

The key points of Environmental Board Rule 70 include:

- Underground installation is encouraged whenever feasible (Rule 70 (A)(1)).

- The installation of underground utilities should be coordinated between all utility companies (electrical and non-electrical).

Scenic qualities should be preserved and installation should be completed "such as to not have an undue adverse effect on the scenic and aesthetic qualities and character of the area. In the district commission's analysis of 10 V.S.A. §6086 (a)(8)(aesthetics), due consideration shall be given to making the line or facility inconspicuous; screening it from view; lines of sight from public highways, and residential and recreational areas; height, number, color, type, and material of poles, wires, cable, and other apparatus; width and degree of clearance of natural growth and cover; encroachment on open spaces, historic sites, rare and irreplaceable natural

areas, and conspicuous natural out-cropping on hillsides and ridgelines of exposed natural features of the countryside" (Rule 70(A)(3)).

Act 250 (10 V.S.A. 151) – Vermont Land Use and Development Law

The Act 250 process (enabled under 10 V.S.A. 151) currently provides the most direct review of line extensions within the state. According to Environmental Board staff and district environmental offices, the number of applications specifically for line extensions under Act 250 is relatively small. Many larger development projects involving subdivision have utility line extensions (new corridors or relocations) as major components of the projects.

The Act 250 process for utility line extensions first involves the calculation of "development" as defined in Rule 2(A). The applicant (utility) is still required to seek a jurisdictional opinion (EBR 2(A)(12) if a project involving work in an existing corridor is deemed a substantial change and is of sufficient size to trigger review. Review is not needed if the size limits (new and existing corridors) do not trigger Act 250. A formal Act 250 application must contain:

- General Location Plan
- Plan showing the location of poles, substations and/or transformers
- Locations of highway rights-of-way
- Location of property lines for properties involved in the project
- Proposed right-of-way location
- Elevations of any buildings constructed for the project
- Specifications for poles, structures, etc.
- Plans for revegetation or replanting as appropriate.
- A description of the surrounding land, including buildings, land use and forest cover.
- A description of why a new corridor must be used versus an existing corridor.
- The applicant must make an effort to explain why underground installations are not possible and why a new corridor is needed over an existing one.

Utility lines are treated like all development under Act 250 and are reviewed under the same criteria.

Vermont Municipal and Regional Planning and Development Act (24 V.S.A. 117)

Although this statute most directly relates to the role of the local municipality in planning and land development, it is through this statute that certain non-discriminating ordinances are enabled that can regulate the type and form of line extensions. Many communities have used the provisions of 24 V.S.A. 117 to specify the burying of power lines for new subdivisions or within designated districts.

Act 200 (1988 Growth Management Act) & Vermont Municipal and Regional Planning and Development Act (24 V.S.A. 117)

The 1988 Growth Management Act was a landmark in planning policy for the State of Vermont. Twelve specific Planning Goals were outlined, many of which can be directly or indirectly impacted by distribution line extensions.

The twelve goals of Act 200[1] are:

1. Plan development so as to maintain the historic settlement pattern of compact village and urban centers separated by rural countryside.
2. Provide a strong and diverse economy.
3. Broaden access to educational and vocational training.
4. Provide safe, convenient, economic and energy-efficient transportation systems.
5. Identify, protect and preserve impact natural and historic features of the Vermont landscape.
6. Maintain and improve air, water, wildlife, mineral and land resources.
7. Encourage efficient use of energy and develop renewable resources.
8. Maintain and enhance recreational opportunities.
9. Encourage and strengthen agricultural and forest industries.
10. Provide wise and efficient use of natural resources and preserve aesthetic qualities.
11. Provide available safe and affordable housing.
12. Plan, finance and provide efficient public facilities and services.

Electric distribution line extensions most directly impact 1, 5, 6, 7, 10, 11 and 12. These seven goals relate directly to land development, aesthetics, settlement patterns and the preservation of environmental quality. Each department of state government is required under statute to assess the implications of these twelve goals on their operations and jurisdictions.

Vermont Agency of Transportation (Including 19 V.S.A. 16)

Many line extension or relocation projects are coordinated with and through the Vermont Agency of Transportation (VAOT). VAOT may pay for a portion of the costs of relocation (19 V.S.A. §1603) when it is associated with the construction, improvement or reconstruction of a highway. The statute goes on to state that reimbursement may be made when "the required design and installation of utility facilities exceed normal relocation requirements as a result of the highway project's need to address environmental considerations, non-discriminating local ordinances, safety considerations or other requirements found to be applicable by the Agency of Transportation (§1605)."

The statute further states that before reimbursement is made, other alternatives must be considered including underground and overhead installations. Also, utilities located on private property that are impacted by the construction may also be eligible for reimbursement.

[1] Shaping Vermont's Future; A Citizen's Guide to Open State Agency Planning (1991)

Section C: Current Practices and Objectives

The most recent Vermont 20-Year Electric Plan (1994) completed pursuant to 30 V.S.A. §202(e), provides a blueprint for the current practices by electric utilities for line extension projects. The plan makes several statements regarding the extension or relocation of distribution lines and the potential impacts to aesthetics. It states that "any relocation or expansion of distribution lines can have a significant affect on the state's landscape and should be undertaken with care."[2] The plan goes on to suggest the following ways to improve reliability associated with distribution lines:

- Utilities adopt a comprehensive right-of-way maintenance program.
- Require that all distribution laterals be fused.
- Conduct pole inspection regularly.
- Place lines underground to reduce exposure to weather.
- Use of distribution transformer load management programs.
- Move cross-country lines to roadside locations.

It appears that some utilities have taken steps to implement these suggestions. Some utilities have comprehensive maintenance programs, examine the use of underground lines and have internal policies to increase reliability through relocation of cross-country lines to roadside locations.

Figure 2- Roadside pole on community green

[2] Vermont Twenty Year Electric Plan, Vermont Department of Public Service (1994)

Section D: Interviews

A central element of the study was to conduct a series of face-to-face interviews with stakeholders to Docket #5496. The purpose of the interviews were to gain a better understanding of the issues surrounding line location policy, establish trends or themes to these issues, and to get feedback on possible case studies that could help further illustrate how current policies and practices affect line extension projects.

Several of the attendees at the workshop were interviewed. Utilities representatives included an Inventory-Owned Utility (IOU), a cooperative utility, a large municipal utility and a small municipal utility. State agencies interviewed included Vermont Agency of Transportation, Vermont Department of Housing and Community Development, Vermont Environmental Board, District Environmental Commission #5 Staff, Agency of Natural Resources and the Vermont Department of Public Service. The interviews were generally free discussions. Issues on the permit process, the impact of operations on line location policy, and extension costs were typically discussed.

The following observations were adapted from notes of the conversations. Thoughts and issues have been reorganized in some cases to better illustrate the points of the discussion.

Investor-Owned Utility

Central Vermont Public Service (CVPS) was selected as the representative investor-owned utility by the consultant team. On January 31, 2002, a meeting was held in Rutland, Vermont with CVPS to discuss the line extension policy issues. As the largest investor-owned utility in Vermont, CVPS brings a broad perspective on this issue. The CVPS franchise consists of urbanized areas (Rutland, Woodstock) and relatively rural communities (Jamaica, Roxbury) as well as suburban transition areas.

Key points

- CVPS has generally adopted a policy of moving off-road lines to on-road locations. They have cited safety, access, increased reliability and ease of maintenance.

- CVPS suggested that underground tap lines capital costs can be 50% more than for overhead when the customer provides trenching work. CVPS, citing a Canadian Electric Association study, suggested main line underground lines cost upwards of seven times equivalent overhead lines. CVPS estimated capital costs for main line distribution extensions at $30 per foot (overhead) versus $220 per foot for underground.

- CVPS has about twenty Act 250 reviews per year on projects. The most common issue is aesthetics. Other issues that do arise include impacts to wildlife and wetlands. CVPS stated that it spends a considerable amount of time addressing wetlands issues through the VT Wetlands Rules and through Section 404 of the Clean Water Act.

- CVPS indicated that most projects were done to increase reliability or to upgrade other services (telecommunications and cable). Few projects have been completed as a result of load growth.

- The triggers for review (jurisdictional opinions) seem to vary between district commissions and coordinators. The new dimensional triggers (Environmental Board Rule 2A), were jointly proposed to the Environmental Board and PSB. The intention was not to increase or decrease review. CVPS believes the number of permits is going down because they use a 20- foot clear zone within the right-of-way.

- CVPS stated on several occasions that the design process for a project is influenced greatly by the acquisition of easements from individual landholders. Two or three poles along a new extension can trigger issues with the public. Several towns, where projects have raised concerns in the past, are on a notification list to alert them whenever any project is scheduled.

Observations and Issues

CVPS has a full-time environmental coordinator who evaluates potential impacts prior to Act 250 permit submission. They also indicated that because of their vegetation maintenance program and narrow clearing limits (twenty feet), they are reducing the number of permits required under the law. Historically they had used a 30 or 50 foot right-of-way for determination of jurisdiction.

CVPS also has made an argument that the costs of underground installation for main lines are prohibitively expensive. CVPS presently has only 300 miles of underground line versus 8,000 miles of aerial line. They seemed less concerned about underground tap lines to individual homes or subdivisions, but noted that most subdivisions within the franchise have overhead electric lines. CVPS does require looping of underground lines to increase reliability.

CVPS seemed most concerned about creation of policy that would require the installation of underground lines. In subsequent correspondence with the consultants, CVPS provided substantial information on the need to balance reliability goals with the need to reduce aesthetic impacts. They do not believe that the benefits of underground distribution lines outweigh the actual short and long-term costs.

Large Municipal Utility

Burlington Electric Department (BED) was considered a representative of a large municipal utility. According to Robert Alberry, about 45-50% of the distribution network of BED is located below ground. This network is comprised of a variety of voltages and has a large percentage of terminating cabinets and transformers located below grade. This network is somewhat unique to relatively rural Vermont.

Key points

- BED has some of the highest costs per linear foot for underground installations in the State of Vermont. They attribute much of this additional cost to the high percentage of underground installation, although they have not had a rate case in nearly ten years and much undergrounding work has occurred since that time. They also have the highest customer density within the state.

- The underground infrastructure has resulted in several important operational problems that they have had to deal with. Firstly, they indicated that many of the vaults have water infiltration problems and require constant pumping. They also indicated that the characteristics of these vaults require its crews to have confined space entry qualifications and training.

- BED has developed software and computer monitoring systems to more quickly determine the location of failures, but access is still difficult and replacement time is longer than for aerial lines.

- BED coordinates its activities with the Burlington Planning & Zoning on new projects in an open public process. Requirements for area lighting for new projects has resulted in some difficult issues as alternative lights fixtures have increased costs for ratepayers. "Gateways" to the City are required by ordinance to have underground electric infrastructure.

- Many older poles have not been removed by non-electric utilities after the successful migration underground or to alternative aerial installations.

Observations and Issues

BED represents a unique perspective on the line location issue. They have a large percentage of main line underground installations with completely buried electric infrastructure. They believe that this infrastructure has resulted in additional costs and operational burdens that the utility has placed on its ratepayers. BED believes that its biggest challenges are containment of costs and dealing with regulatory requirements.

BED would like any policy requiring undergrounding to fairly consider the issues of cost and who should pay. They are presently operating under a municipal ordinance that requires undergrounding within limited areas of the City, but get many requests for buried lines for individual properties. They estimate that the cost of work within the public right-of-way increases costs by more than 50%. They cited the cost for roadside construction, traffic control and working around other buried infrastructure. The least-cost approach has forced some projects to examine private lands for installation of lines.

Small Municipal Utility

Morrisville Water and Light (MWL) is a contrast to BED. Whereas BED has a high percentage of underground distribution lines, MWL is predominantly overhead. Serving 3,400 customers, the utility has roughly 90% of its 275 mile distribution network located on-road. MWL has made a concerted effort in the past twenty years to decrease its off-road lines.

Key points

- MWL has increased its on-road distribution network from 50% to nearly 90% in twenty years. This effort was driven by the need for increased reliability and safety.

- Off-road service by climbing poles is limited to lines of 5KV or less by

APPA (American Public Power Association) safety manual.

- Higher voltages require the use of hot sticking or platforms. MWL stated that working under these constraints is difficult for a small utility.

- MWL has not been required to submit an Act 250 application in twenty years. They have had to secure permits for work within the public right-of-way on State highways.

- Verizon and cable have prompted many projects. Verizon has been slow to remove old poles.

Observations and Issues

MWL appears to represent many of the smaller utilities in the State of Vermont and in fact was selected by the other municipal utilities as a representative. While others in this group may have slightly different characteristics of their distribution networks, it is clear that the movement towards on-road installations and extensions is common. The reasons cited include reliability and safety. In fact, MWL went to great lengths to convey the technical and safety concerns of working in remote areas and how the small size of their operation limits their abilities to manage off-road infrastructure.

This interview suggested possible differences in operational capabilities between larger and smaller utilities. Scale economies for distribution line cost containment have been documented nationally[3]. MWL would appear on the low end of this scale. Like all regulated utilities, small municipals would be mandated to conform to any approved extension policy. Based on our interviews, some utilities may require additional staff to meet new mandates. They could also address new policy issues collectively through the Vermont Public Power Supply Authority (VPPSA). Although the basic mission of VPPSA relates to power supply and financing, they have assisted on ancillary services in the past.

Counsel for the small municipal utilities expressed some concern over the "legal foundation and accuracy" of this study, but did not provide details.

Cooperative Electric Utility

The Vermont Electric Cooperative (VEC) is a cooperative utility with a large, low-density franchise that extends across the state. VEC has roughly 1,670 miles of distribution line and 16,700 customers. About 50% of this line is located off-road and very little is located underground in urban settings. The majority of underground installations are within subdivisions.

Key points

- VEC stated that it has a reasonable relationship with the Act 250 review process, but they feel it may not be the best place for review. Annually, they apply for 5-10 projects as an applicant or co-applicant with a developer or other service provider. According to VEC, the Act 250

[3] Kwoka, John E. (2001) "Electric Power Distribution Costs: Analysis and Implications for Restructuring" American Public Power Association.

process is much clearer than the §248 process with DPS/PSB.

- VEC has an informal policy of relocating or extending new lines along the roadways. This has been driven by the need for higher reliability. Trees in rights-of-way are responsible for roughly 70% of the outages.

- VEC tries to maintain a 50-foot right-of-way, although as a cooperative utility, they provide a higher level of deference to the customer who is also a cooperative member. VEC has allowed creative solutions to specific cooperative members on tree planting within rights-of-way, use of tree wire to reduce clearing zones, and coordination of tree clearing.

- Operational issues have been a challenge to VEC. Remote pole locations require crews able to climb lines. Mutual aid has not worked well because when big storms hit, all of Vermont is affected and utility crews from Massachusetts have little experience climbing poles.

- Underground utilities are becoming more common for tap lines as the costs to the customer have been reduced. This is due in large part to allowing customers to bury conduit with minimal supervision from VEC. Costs can be reduced from $3.99/foot for single phase to $2.20/foot when work is performed by customer.

- VEC suggested that main line underground installations could cost 3X as much as overhead and add $0.05/kwh to rates. These estimates were not later substantiated by VEC and were likely broadly defined guesses.

- VEC cited problems with coordination and cooperation with other utilities, naming Verizon as being a major problem particularly on the issue of removal of old poles.

Observations and Issues

VEC represents a somewhat different model than the other utility types examined. While all utilities have obligations to provide excellent customer service, VEC appears to provide a higher degree of flexibility in its design and approach with its customers/cooperative members. While this degree of flexibility is not completely known, the interview suggested that this has created unique installations and extensions of service that may not be "least-cost" in a traditional sense, but are more reflective of the value of aesthetics for an individual landowner. A case in point on this topic is the use of tree wire. VEC estimated that it would add $0.40/foot to the conductor costs and require a waiver from REA, but could reduce clearing.

VEC also expressed considerable concern about the lack of attention to abandoned infrastructure by Verizon. Many cooperative members have identified this as a big issue. They indicated that they have tried to consolidate infrastructure where feasible.

Telecommunications Utility

Although not directly a party to Docket 5496, the consultant team arranged an

interview with Waitsfield-Champlain Valley Telecomm (WCVT) in order to assess the impact of non-electric utility provider activities on the form and frequency of line extensions and modifications. It had become quite clear in our initial evaluation of the issues and through earlier interviews that interaction with these non-electric utilities had prompted line extension projects and raised issues about aesthetics and land use implications.

WCVT operates generally within the Mad River valley and towns such as Starksboro, Hinesburg, and Lincoln. They work cooperatively with Green Mountain Power (GMP), VEC, CVPS and Washington Electric Cooperative. WCVT cited a recent rule (PSB Rule 3700) which opens up competition in the telecommunications market and could induce the need for more structures and attachments to existing pole infrastructure.

Key points

- Telecommunication line infrastructure is generally at the bottom of the poles and has the lowest clearance requirements as stated in the National Electric Standards (Table 232-1). This code allows insulated communications lines to within 9.5 feet of the ground surface above pedestrian or restricted traffic locations.

- When WCVT makes the decision to go overhead versus below ground, it is done on a case-by-case basis. They evaluate the line and pole conditions, but do not anticipate or project any future growth pattern. The trend is towards more overhead installations to reduce costs of upgrading or expanding service.

- The increasing size (diameter) of the telephone lines is directly due to growth pressures on the utility. Pairs of copper lines are used for distribution of signals and are done usually in increments of 50 or 100 pairs. Fiber optic lines are only used for main office to main office connections. Installations have a twenty-year life cycle.

- Less than 1% of their telecommunication network lines are off-road. They are trying to get all lines along the roadway.

- WCVT stated that the Act 250 process is better defined under the revised rules. They also do many joint Act 250 applications with CVPS.

- WCVT suggested the consultants examine a recent decision or ordinance in Charlotte that forbids overhead utility line extensions.

Observations and Issues

The comments and issues raised by WCVT are quite clearly important to the understanding of the aesthetic issues surrounding distribution line extensions. Although such utilities are not party to Docket 5496, the impact of their actions do have a profound affect on the public perception of line extensions and modifications. In the public eye, there is little distinction between electric utilities, telephone or cable when the issue of impact from a line extension is evaluated. Although WCVT and other non-electric utilities have joint-ownership arrangements

for poles and infrastructure, it appears that the electric utilities bear much of the impact from public comment regarding removal of abandoned poles, etc.

It is also clear from the conversations with WCVT that the growth of the telecommunications network has been done cooperatively with electric utilities by virtue of joint-ownership or maintenance agreements. WCVT did not provide information on what percentage of line extension or relocation projects are the direct result of the need to expand or consolidate telecommunications infrastructure. The suggestion from WCVT is that many line extension projects are completed jointly as part of consolidation efforts, not as a means to accommodate electric line load growth.

Vermont Department of Housing and Community Affairs

The Vermont Department of Housing and Community Affairs (DHCA) is the state agency which directs community planning, historic preservation and affordable housing programs. In this capacity, the DHCA is primarily interested in land use and growth implications of line extensions and the preservation of historic community character.

Key points

- DHCA is primarily concerned about growth and the impact that line extension policy would have on direct or secondary growth.
- DHCA staff indicated that one component of this issue should be to examine how "off the grid" properties are treated relative to mortgage financing and how the cost of alternative energy systems versus line extensions should be examined.
- The issue of cellular communications towers was raised in the following context; can additional future connections be limited or denied to a distribution line extension granted as part of an Act 250 application for a cell tower? DHCA believes that many telecommunications projects are requiring extension of service.
- Aesthetics was not as critical to this issue in DHCA perspective. This is based on the perception that distribution lines are ubiquitous.

Observations and Issues

DHCA provided a very interesting perspective on the issues of this study. The analogy between utility line extensions and sewer lines was discussed during the interview. The DHCA, as part of a concerted effort of Vermont State government, has been very active in the analysis and assessment of growth (primary and secondary) induced as a result of municipal sewer line extensions.

DHCA is interested in regulatory policy that could be used to limit or direct growth within certain areas in a clear and definable way. The extension of such policy to the distribution line extension issue revolves around two key points. Firstly, the degrees to which line extensions induce or contribute to growth and secondly, whether or not alternative generation systems could be installed that reduce the need for line extensions. They feel these are both central issues to this study.

Vermont Agency of Natural Resources

Vermont Agency of Natural Resources (ANR) is more focused on two major concerns. Firstly the aesthetic impact of line extensions in areas of state-wide scenic quality and secondly the potential for line extensions to affect the location and pattern of development; such as scattered residential development in remote rural areas, and thus the secondary effect of those patterns on communities and the environment. As the state agency in charge of environmental and natural resource protection, ANR is interested in finding ways of reducing sprawl and protecting scenic resources.

Key points

- ANR has been focused on the cell tower issue in the recent past and believes that power lines and cell towers have different visual impacts.
- A central growth concern is the proliferation of "castles on the hill", large single-family homes and other scattered residential development in remote hillside locations. This type of development has the potential to fragment wildlife and forestry resources and may affect water quality in upland areas. High elevation development also often has aesthetic impacts because it is visible for great distances. ANR would be interested in determining if the costs of development are reduced on class 4 roads as the result of line extensions. Does this growth lower the bar for future development?
- The suggestion was made that topography may provide the appropriate factor for limiting extensions. Much like watersheds, utility infrastructures impacts extend beyond town boundaries.

Observations and Issues

The perspective of ANR regarding the issues of line extension is related to how these projects contribute to the loss of scenic quality either directly or indirectly from growth. The social costs of line extensions (namely aesthetic) is of interest as is how best to regulate or limit extensions. Of particular interest from this issue is the notion that a scenic process needs to be defined for distribution line extensions.

ANR is the principal state agency that reviews the aesthetic impacts of development projects. This review process, generally through Act 250 Criterion 8, is done under the framework of the Quechee Decision and the ANR Scenic Resource Evaluation Process. Criterion 8 is dynamic and "was not intended to prevent all change to the landscape of Vermont or to guarantee that the view a person sees from his or her property will remain the same forever." [4]

Act 250 Criterion 8 states that a project must not have an "undue adverse" effect on the scenic quality of the area. The Quechee Decision sets out a framework for understanding when a project is "adverse" and "undue". The basic test for determining when a project is "adverse" is to examine the project's visual context and determine whether or not the project design "fits" within this context. If a project is

[4] Re: Okemo Mountain, Inc., #2S0351-8-EB, Findings of Fact, Conclusions of Law, and Order at 9 (Dec. 18, 1986)[EB #305]

found to be "adverse" then the Quechee Analysis provides three criteria to determine if the project is "undue". They include:

- Does the project violate a clear written community standard?
- Did the applicant fail to take generally available mitigating steps?
- Does the project offend the sensibilities of the average person?

A positive response to any of these criteria suggests a project would have an undue adverse impact to the scenic qualities of the area

It is through this process that all Act 250 aesthetic review of line extensions is completed.

Vermont Environmental Board / District #5 Environmental Coordinator

The interview with the chief coordinator for the Environmental Board and the District #5 Coordinator centered on a discussion of recent revisions to EBR 2(A) and EBR 70. These changes were the result of a collaborative effort with DPS, the regulated utilities and the Environmental Board. The changes were done in 1999 and helped clarify the calculations for jurisdictional determination of "development" under Rule 2A (12). A separate discussion with April Hensel of the Windam (District 2) was held.

Key points

- The changes are so recent that they do not know the affect they are having on the process yet.
- The compliance with Act 250 is not known. Given the nature of these projects there may be some that are not reviewed as required.
- Public comment is not widely heard on these issues; generally individuals have objections.
- Rule 70 sets forth policy goals and suggests undergrounding whenever feasible.
- The District #5 Coordinator stated he had heard very little "ruckus" on this issue and has less than 1 major case a year.

Observations and Issues

It would appear from our conversation with the Environmental Board that the distribution line issue has not reached a high level of public interest. Perhaps the relatively few numbers of applications a year that reaches the Environmental Board and the ubiquitous nature of electric line infrastructure contribute to this.

It is also clear from this interview that the Environmental Board and the entire Act 250 review systems present caseload appears to be about as much as they can handle given current staffing and resources. Any suggestion of changes to Rule 2A should address the issue of resource allocation to handle additional caseload.

Vermont Agency of Transportation (VAOT)

The interview with VAOT provided the consulting team with the opportunity to discuss several key issues raised during the workshop; funding of utility infrastructure as part of highway construction projects, VAOT permitting requirements and utility/traffic safety interactions.

Key points

- The funding mechanism for utility relocations is addressed in statute under 19 V.S.A. Chapter 16. It enables the State contribution to be 50% or higher for state highway projects. Town highway projects have a maximum match of 50%. The matching dollar amounts are based on an analysis of the differing costs between utility relocation and burying the service.

- Special legislation can (the case of Danville was cited) result in contributions higher than 50% for non-state highway projects. The Agency does not budget for underground installations in its scoping process. Unanticipated undergrounding expenses have resulted in large (greater than 50%) expenditures above original scoping projections.

- VAOT handles nearly 300 permits a year from utilities to conduct work within state highway rights-of-way. They are reviewed for safety issues (compliance with required isolation distances) and the potential for any interactions.

- Special conditions of permits require removal of old poles in a prompt time period (six months seems typical).

- The record of compliance with electric utilities has been good; Verizon has been very slow..

- The Agency is beginning the development of a safety management system to analyze the incident of car/power pole accidents. Poles are hazards in the right-of-way, as are guardrails.

Observations and Issues

It would appear that VAOT conducts the majority of the review for utility projects statewide. While they are focused exclusively on impacts of the projects to state highway, they do set forth requirements for compliance that directly impact the aesthetic and scenic environment.

The funding of utility projects under VAOT review is also extensive. Projects like Dorset Street in South Burlington instigated a change in policy in 1995. The new policy places a significant portion of the costs of undergrounding on the municipality (50%) and out of the federal/state resource pool. Some municipalities have in turn passed these costs along to the utilities. The circumventing of this policy (19 V.S.A. Chapter 16) through enacting of special legislation allocating funds in excess of matching requirements appears to be a concern of VAOT.

While safety issues were raised in the December 2001 workshop, it is clear from our conversations with VAOT that <u>any</u> object within the right-of-way is a potential hazard. VAOT has been asked and is reluctant to place guardrails around power poles, as the guardrails themselves become the hazards. The new safety management system will eventually help evaluate what is happening during accidents and could be used to refine policies or design criteria.

Vermont Department of Public Service (DPS)

The DPS has extensive interaction with the regulated utilities by virtue of its role as overseer to the industry. In this capacity it acts as both a representative of the ratepayer and regulator.

Key points

- The DPS was clearly interested in getting the information needed to help formulate policy.
- They believed that the issues of costs are central to the discussion and should be addressed.
- They discussed the need to address on-road vs. off-road installations. They believe that the land use issue are complex and feel somewhat stymied.
- DPS indicated that they do get involved in Act 250 cases periodically, often related to energy efficiency issues.
- They also wanted to explore policies that provide direction to the extension form but might have caveats to balance aesthetic/land use and operational issues.

Observations and Issues

DPS is at the front of the line extension issue. Present extension policies and any future policy will most likely be implemented, in part, by DPS. In their estimation a purpose of this study is to help move policy to address these issues.

Section E: Literature Review

As part of the study, the consultant team conducted a lengthy series of literature searches for information on the interactions between utility line extension policies and aesthetic, environmental and land use issues. Using Lexis/Nexis and other search tools, several important source documents were found which contribute materially to the discussion of these issues and in evaluation of policy options. These documents are summarized in the References section of the report and cited throughout as appropriate.

Section F: Summary

The interview process conducted for this study revealed a great number of issues and potential impacts to land use, aesthetics and environmental factors. It also provided the consultant team with several potential case studies through which to more closely understand these issues.

Part II: Analysis of Issues

Section A: Introduction

The issues that were raised during our initial interviews and research formed the starting point for the analysis. The goal was to clearly illustrate the issues through relevant case studies, analysis of costs and consideration of other research.

In order to discuss these issues, some basic working definitions related to line extensions had to be made.

Line Extensions as considered in this study include projects that increase the length of the electric distribution network into new service areas; relocate existing distribution lines to new poles, change alignments between overhead (on-road or off-road) and underground, or increase the height of existing poles to accommodate additional capacity or non-electric infrastructure.

Aesthetic issues are those dealing with the interaction of a line extension project on the scenic or historic character of the area. Aesthetic issues will be generally discussed in light of public impacts or perceptions.

Land Use issues consider the role or impact of line extension projects on the location of growth (where growth occurs), settlement pattern (the form that growth takes), and the degree to which line extension projects can alter the rate of growth.

Environmental issues are regarded in this study as those related to natural resource factors including wetlands, vegetation, environmental health, wildlife, water and water quality, etc.

Section B: Case Studies

Recognizing the working definitions for the major issue areas, three case studies of actual line extension projects were selected. The selection was further refined to ensure these projects:

- Could provide insight into one or more of the major issues of the study (aesthetic, land use or environmental)?
- Represented a variety of land use contexts (urban, suburban, and rural)?
- Had information available that could help in understanding the implications of the projects?

The cases included work along Blood Brook Road in West Fairlee; West Bolton and Main Street in Burlington. During the interview process and in subsequent research on the issues, it became clear that the three selected case studies represented a reasonable cross-section of the types of project occurring across the state.

An impact questionnaire was created that addressed the three major impact areas as well as provided opportunities for operational, safety, cost and reliability issues to be discussed.

The case studies were completed in cooperation with the utilities providing service, through site visits and interviews with property owners, review of plans and supporting legal documents, research on development trends and interpretation of photographs and map information.

Case Study #1: Town of West Fairlee

Appendix 1 contains the documentation from our review of the Blood Brook Road case study. This includes the completed questionnaire, the original and final design plans and photographs of the alignment.

What was the proposed extension?

CVPS proposed the relocation of an off-road line single-phase circuit to an on-road location. Construction of the 13,700-foot extension occurred in October 2000. This project was of sufficient length (West Fairlee has no permanent zoning) to trigger Act 250 review and a public hearing was held in November 1999. Six property owners received party status (under criterion 8) and the District #3 commission requested, among other things, that CVPS explain their clearing regime (stump removal, etc), provide documentation on the minimum distance from pole to the road centerline, and explain why a small segment of the line was to be cross-country and whether or not the CVPS forester could meet with the residents to discuss their concerns.

What was the nature of the impacts?

The scenic context of the area was originally one of quiet natural beauty. The tree lined road moved through a series of rolling hills, pastures and transitional meadows and some wooded segments. The human environment consisted of some houses (many older) near the road in traditional architectural styles. Nine of the homes are listed on the Vermont Register of Historic Places and the road had been mentioned in the writings of authors Ted Levin, Robert C. Morey and Sheldon Miller. The viewshed for the project was relatively confined, but several vistas outward (westward) were observed. The project is visible from the roadway in almost all areas and from many of the adjacent properties.

From several of the residents' perspective, the project as originally proposed was unacceptable. In an interview with Carol Cutler, one of the property owners, the consulting team learned that the major issue was the aesthetic impact of the proposed removal of trees. The residents, when faced with the original alignment, sought assistance from the County Forester who they felt acted as an "advocate" on their behalf.

The project as ultimately designed introduced a new visual element into the roadside environment that was previously not present. While the original line had long cross-country segments (See Appendix 1) the new alignment moved the vast majority

Figure 3- Blood Brook Road showing riser pole

of the poles to roadside locations; introduced several "crossovers", and moved the line slightly behind areas of native trees in order to preserve them. One property owner (Bailey) sought and paid for the burial of a short segment of line along the road frontage. Photographs of the line show the characteristic of the alignment as finally constructed (See Appendix 1).

The Town of West Fairlee is without any zoning but did state in the Town Plan to "place power lines, tower, roads, drives and similar structures in a manner as to reduce the visual impact, if any." The Two-Rivers Ottauquechee Regional Plan states that distribution lines should "consider visual impacts," "minimize the removal of vegetation," and provide "screening [of] views of lines from highways."

While the town plan and regional plan do have language regarding placement of distribution lines, such language is not a prohibition. These documents essentially encourage the minimization or mitigation of impacts. The final design moved three poles from roadside positions behind a low stone wall and used the "crossovers" to preserve important wooded edges along the road (Figure 4).

According the Commission, the final design took reasonable steps to mitigate the impacts of the project.

Although the lines are placed along the road, they are well screened by the retained vegetation and with only a couple of exceptions, the final clearing completed did not raise concerns. The utility also preserved many large trees that under the original design might not have been retained. The project also improved the views to the west by removal of the original line. It seemed clear that reasonable steps to mitigate impacts were made.

What was learned from this case?

This case points to the most commonly cited public concern over line extensions, aesthetics. The basic elements of aesthetic concern are present:

- Local residents who were most directly affected by the project raised the issues. Of the total number impacted, only a handful pursued the issue with vigor.
- The public did not fully understand the technical and operation issues related to design of distribution

Figure 4- Cleared roadside with preserved pine

lines.

- When faced with the cost of underground versus overhead (they were told it would be two times the overhead line costs), the decision to use overhead installations was nearly universally chosen.
- The public interviewed did not feel the Act 250 process was the right place for this discussion. The District Commission, in some way recognized the same by recessing the hearing to allow for a consensus process. The final Act 250 decision reflected this process.

The consensus approach to this case appeared to work well. The local residents, most directly impacted, were afforded an opportunity to participate in the design process; public concerns were raised and debated in an open forum and the goals of protecting natural and scenic resources were achieved.

This type of relocation appears to be common as off-road segments are moved to on-road configurations. The scenic context appears to be a big determinant of how the impacts are distributed. It also points to how unique design solutions, collaboratively reached with affected persons, can be used to create aesthetically acceptable outcomes.

This case study also suggests that line extensions on new roads, whether rebuilds or new construction, need to be evaluated on a case-by-case basis.

Case Study #2: West Bolton, Vermont

Population growth in Bolton has, according to the 2000 United States Census, fluctuated since 1980 with several distinct periods of positive growth since 1980. From 1980 to 1990 total-housing units within the town increased from 359 to 543 (184 units or nearly 34%). Occupied housing units (non-season, single-family for the most part) increased from 260 to 367 units (107 units or 29%). This information suggests that the secondary vacation home growth was roughly 77 units. Since 1990, however, the rate of growth has decreased or stabilized with total population, rate of population growth and occupied housing units staying basically flat or decreasing slightly. In fact, new migration to Bolton changed by –150 persons between 1990 and 2000.

The West Bolton area (See Appendix 1) consists of two main class 3 roads (Notch Road and Stage Road) as well as several smaller class 3 and 4 roads. Notch Road and Stage Road have had very different line extension forms. Mill Brook Road (located just north of the Bolton Country Club) is a class 3/4 road that is served by off-road lines. Each of these road segments provides some insight into the line extension process and the potential influences on growth patterns.

The consultants used research at the town offices, site visits, Global Positioning System (GPS) field mapping) and GIS databases as part of the analysis process. We also contacted VEC on several occasions to confirm the dates of extensions by pole numbers.

What was the nature of utility line extensions?

Figure 5- Recent construction along Notch Road in Bolton

Notch Road

Prior to the mid-1980s, Notch Road consisted largely of camps and single-family homes that existed off the grid. The Notch Road / Stage Road area is served by Green Mountain Power and VEC. It appears that VEC owns portions of the line at higher elevations, while in the lower areas, particularly as you approach Route 2 the ownership changes to GMP.

The scenic context of the area was, and for the most part, is still quite beautiful. The area has a rugged natural quality with areas of dense woods, rock outcropping and extended views of the Bolton Notch. Notch Road has the most dramatic views as it makes its way through the actual notch. The topography, although steep, does have some plateaus that allow for development (Figure 5).

The land use context of the area was very rural in the early eighties. Many of the structures along the northern portion of Notch Road (See Appendix 2) were alternative energy, as electricity was not extended until 1986. A review of parcel records indicates that a single landowner initially divided his property which included both sides of Notch Road. Subsequently, two extension requests were made to extend service.

Although this subdivision appears to have happened over a number of years (1983-1985), an area near and including the Duck Brook Circle condominium development was divided approximately 1985-1987. These lots are characteristically 10+ acres, taking advantage of the exemption from

Table 2: Notch Road Line Extensions

Extension #	Length	Lot (deed reference)	Lots currently served
1	2200' +/-	Campbell – Vol 33/pg 334	16 +/-
2	500' +/-	Kuzins – Vol 38.	8 +/-

onsite septic requirements at the time. (See Appendix 1 details of this area). Table 2 summarizes the two initial extensions.

Following these initial extensions a total of roughly 24 lots were ultimately created. This would indicate that a series of factors had triggered the growth in the area and a number of developers were attempting to capitalize on those factors.

Stage Road

Stage Road appears to have had a longer period of intense human activities as it is more developed in some locations. While it does have areas that could be considered "scenic", it lacks the visual depth, variation in terrain and expansiveness as some portions of Notch Road. The southern portion of the road resides within the Town of Richmond, Vermont and the pattern of subdivision changes (See Appendix 1).

Mill Brook Road

Unlike Notch Road and Stage Road, Mill Brook Road is partly a class 4 road (northern portion) and is served by an off-road single-phase power line. The line makes its way south to north from the intersection of Mill Brook Road and Stage Road through open meadows and then some 300'+ or so off the road as it winds it's way up what eventually becomes a rather steep incline. The area has been subdivided and consists mostly of single-family homes. Some of them are older.

What was the nature of the impacts?

The record of growth along Notch Road, Stage and Mill Brook Road indicates that many of the major factors that can influence development were in place prior to initiation of the line extensions in the mid-1980's

- The Road was a Class III Town Road
- Bolton had no zoning regulations until 1988.
- Topography provided some potential house sites, although the area is steep
- The 10-acre loophole of the septic rules existed. Bolton rocky soils are often poor and undesirable for onsite septic.
- The market – Bolton of the 1980s was a very viable community for growth. The ski area was operating, the picturesque character of the area was unquestioned and the easy commute to both Burlington and Montpelier placed it central to two major growth areas.

A single landowner requested the extension of service to support the operations of a pottery business along Notch Road. Following the extension by VEC a series of subdivisions and developments occurred within a relatively short period of time. While the single owner did initiate the extension, subsequent connections were paid according to the depreciated value of the original improvement.

The impact of the extension itself was only one of many factors contributing to the growth on Notch Road. The subdivision pattern clearly resulted in 10+ acre lots (to avoid on-site septic permitting requirements) and narrow road frontage (to maximize subdivision); the road was present and available for use; water supply was available from wells; other site restrictions could be managed. This case illustrates the complexities of assessing impact of a single factor in this context.

In contrast to Notch Road, Stage Road has had a much longer development history. The site visits and research completed suggest that the movement of the lines along the road were done incrementally, over a long period of time and supported increasing growth towards the north. The ultimate destination of the growth along the road was the West Bolton Country Club and surrounding single and multi-family homes. Table 3 summarizes the land use patterns and settlement forms observed in the West Bolton cases.

Mill Brook Road is bounded on the western edge by the Underhill Firing Range and has some difficult terrain. Despite this, it has developed along the lower portions (Class 3) to density consistent with its capability. It is also very close to the West Bolton Country Club.

What was learned from this case?

The 1992 TJ Boyle report set out a discussion of how in Charlotte and Addison the presence of a line extension and the service drop credit could trigger a particular settlement pattern (long lots with houses at 100' from the road). While this pattern is observed within West Bolton, the cause may not be completely the result of the service drop credit. We observed:

- The lack of zoning combined with state septic rules helped enabled the pattern (long lots of 10 acres) that was ultimately seen along Notch Road. It is imperative that towns recognize any potential for impact on growth from extensions of lines. Subdivision regulations and zoning ordinances should clearly specify how projects would be handled and establish the dimensional requirements that support the appropriate density within designated areas of the Town.

Table 3: Summary of Land Use & Settlement Pattern Characteristics – West Bolton Case Study

Parameter	Notch Road	Stage Road	Mill Brook Road
Line Extension Form	New Extensions – On Road / Off-Road	On-Road	Off-Road
Development Form	Rural Residential	Suburban / RR	Rural Residential
Number of Houses	59	65	13
Number of Lots	73	67	14
Average Lot Size	32.63 acres	16.43 acres	20 acres
Min / Max Lot Size	0.99 acres / 371 acres	0.23 acres / 415 acres	0.09acres / 236acres
Average Lot Frontage	213 feet	133'	> 200'
Average House Setback	91 feet	115'	75' (one 1300' off road)
Miles of Road	4.5 miles	2.82	0.84 miles
Road Class	3	3	3 /4
Density / Mile	13 houses/mile	23 houses / mile	15.5 houses / mile

Town's without such regulations must seriously examine them in light of growth.

- The average setback off the road appears to be roughly 100 feet. While this corresponds well to the typical service drop and the service drop credit, the topography of the valley also plays a role. Notch Road appeared to have mostly underground service drops. Notch Road and Mill Brook Roads also were more consistent with respect to setback, while Stage Road had a higher degree of variability. This possible reflects its longer and more mature growth pattern and less steep terrain.

- The growth along Stage Road shows that even in areas with on-road utility lines, the impact of topography and site can shape the development form. The Richmond portion of the road is steep and densely wooded and development has not been as intensive. The areas near the West Bolton Country Club are much more developable as evidenced by the presence of multi-family housing (Figure 6**)**.

- The location of development is most influenced by road infrastructure. However, line extensions appear, in part, to enable the linear progression of growth along roadways. When the distribution line was extended on Notch Road the location of new houses moved along with it. The pattern and form that development took was defined more by site specific factors (setbacks, market, and topography).

Figure 6- New development on Stage Road.

Figure 7- Long private road with extended utility lines

- The density of development may have some correlation with on-road line extensions forms. Higher densities were observed along Stage Road than Notch Road and Mill Brook Road. Stage Road is nearly all on-road while the other two roads are either all or have a significant percentage of line segments placed off-road. Similarly, the densest areas along Notch Road also have on-road lines. This suggests that where development can occur, the presence of on-road utility infrastructure can enable higher densities.

- Where access is difficult along a main road (i.e. Notch Road), new private drives and roads have been created to support residential development. New extensions were required to serve these areas. Some were noted as underground, others as overhead (Figure 7).

- Comparison of both on-road and off-road systems showed that ultimate development form is most affected by the site constraints. Stage Road has had ready access to electricity for decades, yet certain areas with difficult terrain are not fully developed. Similarly, Mill Brook Road has more difficult access to power (300+ feet from houses in some cases), yet the lower portions have developed to the extent expected based on the nature of the environmental constraints, topography and road. The upper portions have not been built out yet, most likely reflecting the fact of a single (unwilling) land owner, poor road conditions and difficult construction.

Case Study #3: Main Street, Burlington, Vermont

As part of a project to upgrade and enhance the Main Street gateway into the City of Burlington, BED was asked to prepare estimates for and conduct a 1,100 foot underground relocation of several overhead circuits from substation 3 to the University Heights intersection. The area is characterized by extensive pedestrian and vehicular traffic. Main Street is a primary entry point to Burlington from Interstate 89 and bisects the residential and academic campuses of the University of Vermont.

The project was conceptualized in the late 1980's and included significant improvements to the streetscape (new sidewalks and cross-walks) as well as lane widening. The project applied for and received federal matching dollars under the new (then) 1995 policy of VAOT for matching at 50% for underground infrastructure. The relocation of the utilities was considered eligible due, in part, to the road widening that was to occur and the intensive disruption that a short segment of overhead lines would experience. The fact that much of the surrounding area was already underground was a consideration. Actual construction of the project began in December 1996 and BED continued its work through May 2000.

What was the nature of the utility line extension?

The line extension in this case was an overhead to underground relocation. The context was urban and the area was both well traveled (vehicles and pedestrian) and within a campus setting. The City felt strongly that this project, as a major gateway for visiting tourists, students and commuters, would benefit from the removal of the overhead lines in favor of underground infrastructure. In conjunction with the electric line relocation other utilities (telephone, gas, etc) were also relocated and consolidated. The review for the case study concentrated on the 1,100 foot area between substation 3 and University Terrace which was subject to the

Figure 8- Main Street in Burlington.

overhead/underground relocation and connected already underground segments to the east and west.

The issues of cost in this case were important. According to Federal Highway Administration requirements for federal matching projects, when utilities are relocated as part of the roadway improvements, only the cost of "functional replacement" should be considered. Any work outside of "functional replacement" would be excluded from federal matching funds. In the Main Street project, for example, the extension of utilities along Carrigan Drive was considered betterment.

The overhead system between substation 3 and University Terrace consisted of (1) 13.8 kV circuit and (2) 4.16 kV circuits. Photos taken in the late 1980s show the density of the lines that pre-existed (Appendix 2).

What was the nature of the impacts?

This case study best illustrates two major issues; the benefits that undergrounding of utilities in pedestrian environments can provide and the costs associated with those benefits. The before and after photos of the project show that the elimination of the overhead lines helped create a stronger pedestrian-scaled environment by lowering the scale of infrastructure, reducing its mass, and giving it higher levels of detail and refinement. While it is difficult to separate the other improvements completed on the project (and they were numerous), the elimination of the overhead lines was clearly an important element in making the project effective.

Prior to work on the project, BED estimated the overall Main Street project would cost $1.7M ($300/foot). The final overall costs were $1.3M ($220/foot), excluding the temporary overhead relocation.

Table 4 (next page) shows the actual costs within the relatively short segment between Substation 3 and University heights. For this segment the cost was roughly $247 per foot, slightly higher than for the overall project. About 62% of the costs were materials; the rest was labor, engineering and vehicle charges. The cost of the aerial relocation was about $58/foot or 25% of the total.

Duct work was not included in the relocation charges and was estimated at $270,300, but the actual costs were less roughly 25% less. Contractors completed this work for the additional costs of about $183/foot. Factoring these costs resulted in a total segment cost of $430/foot, well over the original project estimate of $300/foot.

According to BED the project was run quite efficiently with few changes and good cooperation between contractors, utilities and VAOT.

Table 4: Summary of Line Relocation Costs – Main Street Renovation Project (MEGC 5000(14)) – Substation 3 to University Heights (1,100 feet)

Activity	Labor	Materials	Contractor/ Engineering	Vehicles	TOTAL
Temporary Overhead – New Lines	$17,582	$14,861	$3,960	$6,886	$43,289
Temporary Overhead- Removal of Old Lines	$14,550	NA	$290	$5,699	$20,539
New UG System Installation	49,880	$154,268	NA	$1,252	205,400
New UG System Inspection	$1,509	NA	NA	$939	$2,448
TOTALS	$83,521	$169,129	$4,250	$14,776	271,676
COST/FOOT	$75.9	$153.7	$ 3.9	$ 13.4	$246.9

Sources: BED Estimates and data from MEGC 5000(14), Work Order System and VAOT Documents for Supplemental Agreements #510.01 / #510.02

What was learned from this case?

This case provided good insight into how the VAOT process works for line extensions and how beneficial the relocation portion of the work can be for aesthetics. The relocation of the substation 3 to University Heights overhead lines did help make the project better. It did not eliminate the presence of surface electric infrastructure and non-electric utilities are found within the pedestrian environment as well. The lighting design is also supported by the infrastructure change. Incorporation of the historic period-style fixtures within the streetscape with overhead lines would have been much less effective.

The project also demonstrated the use of the new VAOT policy on matching requirements. After calculation of all costs, etc., BED was reimbursed roughly 57% of the costs for the segment examined. Other qualifying costs were matched at 100%. BED estimates that it was required to pay about $32,800 for site work and ultimately absorbed $93,271.73 for electric work including betterment.

The City of Burlington, through its franchise ordinance has held that these costs are not the City's but are the utility's to bear for the right to do work within the public right-of-way. This issue has apparently been contentious, particularly with non-electric utilities such as Adelphia and Verizon who disagree.

This project also shows the type of cost that main line underground require. The segment studied was well above the original project estimate, but according to those involved, the project was efficiently managed. An equivalent aerial upgrade would have cost roughly $58/foot (the same as the temporary) according to BED.

Section C: Aesthetics

Several aesthetic issues were observed during our review of the case studies, in interviews and through research. These major issues should be considered when policies regulating line extension are discussed.

Issue #1: Scenic Context

There have been many techniques developed to evaluate impacts to scenic resources. The Vermont Agency of Transportation report entitled "What's Scenic: An analysis of Vermont's current and past scenery evaluation systems"[5] also provided some insight into this issue. This document, prepared as part of the Vermont Scenic Byways Planning Project Statewide Plan - Phase II, includes a very informative discussion on the various technical methods for scenery analysis used in Vermont over the past 30 or so years.

In all of these methods, the issue of the scenic context is central. The scenic context defines the qualities of the visual environment that modify how changes are perceived. The scenic context represents a fusion of the natural landscape and the human environment.

The elements of the scenic context can include natural features such as topography, vegetation patterns, lakes, rivers and ponds. It can also include cultural elements such as historic villages, settlements, roads, etc. The final element includes the composition of the landscape. Composition describes how these various elements arrayed and how are they viewed.

[5] Vermont Agency of Transportation, Scenic Byways Program, 1997.

The Vermont Agency of Natural Resources has developed a process for evaluation of impacts to the scenic resources of the state. The Scenic Resource Evaluation Method describes some of the components to landscape composition. Each of these may be impacted by line extensions in some ways.

Contrast: *Are there clearly discernable and different landscape elements existing side by side, such as: open meadow and woodlands, water and land; mountains and valleys; village and countryside? It is generally accepted that the more contrast between natural elements of the landscape the greater its scenic qualities.*

Line extensions that tend to cross through landscape elements may reduce natural contrast. For example, a heavy utility line placed between a meadow and a pond could visually break the natural contrast of the scenic context.

Order: *Do the natural and cultural features form patterns that make sense in the landscape or are they chaotic and disorienting?*

Line extensions that follow the roadway in simple progression with fewer crossovers tend to have a stronger sense of order, particularly if the roadway was designed sensitively. However, crossovers are often needed to reduce clearing and create visual separation. In wooded contexts this process may promote preservation of order by reducing roadside tree loss. Dead poles juxtaposed to a new relocation can create visual chaos.

Line extensions that break up natural features (cleared right-of-ways) or are out-of-scale with cultural elements (poles taller than surrounding structures) may increase the sense of disorder. Extreme variations in the components of power poles (changes

in type of transformers, colors, etc) might also increase the sense of visual chaos.

Layering: *Is there a succession of landscape elements receding into the distance that provides a sense of depth to the landscape such as: islands and peninsulas in a lake; multiple ridgelines of hills and mountains; a variety of relatively similar building heights in an urban landscape?*

Line extensions that are placed at the foreground of an expansive scenic vista may tend to reduce the sense of layering.

Focal Point: *Is there a point to which your eye is inevitably drawn which enlivens the landscape by its dominance? These focal points tend to be mountain peaks, historic barns, or a church.*

The potential for impact occurs when a line extension becomes the focal point of the landscape. If the eye is drawn to the line extension at the expense of those natural focal points, the observer will notice.

It should also be noted that in many contexts the presence of utility lines are ubiquitous. The public has become accustomed to having poles and wires within view.

Uniqueness: *Does the landscape contain distinctive features that are unique to or symbolic of the region such as a dramatic mountain notch; an unusual style of barn; or a proto-typical village layout?*

The potential for impact occurs when a line extension detracts from these unique features. If poles are placed at the entry to a culturally significant building or a cleared right-of-way bisects a wooded mountaintop, the uniqueness may be affected.

Intactness: *Have the distinctive natural and/or cultural attributes been retained such as a historic village that has remained largely unaltered over the past century; a large area of actively managed farmland; a sensitively designed resort that complements the natural setting; or an historic streetscape where any new infill construction is compatible with the older buildings?*

Figure 9- "Dead" poles along road – loss of order and intactness.

Line extensions have a great ability to affect the intactness of the scenic context. Poles and wires within a historic village reduce its cultural intactness.

Creating projects that do not impact the visual resource requires flexible design and sensitivity to avoid impacts. The linear nature of the extensions means that a single boilerplate solution or design prescription may not be successful.

Issue #2: The Viewer

In order to trigger an aesthetic impact, two things must happen. Firstly, some person must perceive the change. Secondly they must make an internal and subjectively evaluation of the change against some "norm".

The perception of a line extension project appears to be triggered by one of five conditions:

- The clearing of vegetation so as to disrupt the "natural" state.
- The placement of lines, poles or other infrastructure within the foreground or view of an area considered scenic or an area previously devoid of utility infrastructure.
- The consolidation of lines, transformers or other infrastructure (including telecommunication equipment) at higher densities so as to increase the overall mass of equipment.
- The increase in height of existing infrastructure.
- The presence of unused poles either adjacent to or in close proximity to new infrastructure following a line relocation.

For example, in conjunction with roadway improvement to accommodate the new Maple Tree Place development, new overhead distribution lines were installed by Green Mountain Power. The chosen design solution increased the heights of the pole infrastructure by at least 10 feet from pre-existing poles. In addition, new and larger infrastructure was placed on the poles.

The results are very "heavy" structures that are out of scale with the growing pedestrian nature of the area. The norm against which projects are compared is based largely on the idea of scenic context. When the components of the scenic context are impacted (order, intactness, etc.) the "norm" has changed.

Aesthetic issues often arise from the concern of a single or few viewers. Changes to the view from their homes, clearing or loss of trees in the right-of-way or the presence of additional lines all compel individuals to raise issues. Some, more broad public concern has been raised on larger distribution line extension projects, but they are relatively rare. The overarching sentiment is that utility lines are best left out of sight.

There is also a real perception that "dead" poles (abandoned following relocation or consolidation) need to be managed better. Several utilities, VAOT and comments from the citizens' panel have indicated that such practices prolong what would otherwise be transient visual impacts.

Issue #3: Act 250

First and foremost, not all line extension projects are reviewed by an outside party for compliance to state goals, objectives and laws pertaining to aesthetics. Given the number of potential projects statewide that could be classified as an extension (hundreds) and the indicated number of Act 250 applications (dozens), there is not universal review.

As is the case for all development, the triggers for entry into Act 250 are based on spatial factors and not on scenic context. Whereas other natural resources of the state have multiple jurisdictions for review (wetlands-local subdivision ordinances, Army Corp of Engineers, State of Vermont Wetlands Office, NEPA, etc), aesthetics for distribution line extensions may be reviewed in significant detail only under Act 250, particularly in towns without any subdivision or zoning ordinances. This procedural issue may introduce the possibility that a project exempt from Act 250 review could be built and result in a quantifiable aesthetic impact. As described previously, the scenic contexts through which extension occur are quite varied and sometimes small or incremental changes can trigger significant impacts, and does. The line extension components of larger projects needs to be fully addressed.

A second issue regarding the regulatory review of line extensions is that they are often associated with a larger development project. While bundling the development and extension projects together may be efficient, it may also reduce the possibility that the aesthetic issues of the extension are fully addressed. Act 250 certainly can consider these impacts.

Conversely, if review is done outside of Act 250, a connection with the development project may not be made. A case in point on this may be the Husky Injection Molding Systems expansion. The industrial campus development project went through an exhaustive Act 250 review. The upgrade and relocation of electric service along North Road was reviewed under Section 248 as power was taken from a transmission source. For those living on North Road (the main road to Husky) the impact of both projects was observed. New distribution infrastructure composed of taller poles with heavier wires was installed. Clearly if Husky had not required new service the aesthetic environment would not have changed to the degree it did.

The Act 250 process can work to address aesthetic issues, but it does not require submission of off-site alternative alignments or configurations. For example, if an applicant submits an on-road alignment, they are also not required to provide an off-road alternative. A district commission can evaluate whether "reasonable steps" have been taken under Criterion 8, but that places the burden for coming up with alternatives to those without the technical background needed for distribution system design. Alternatives may be a useful tool to give the public and district commissions some room to discuss how to mitigate aesthetic issues, recognizing important operational and service needs.

Issue #4: On-Road vs. Off-Road

The visual perception of "growth" in electric utility infrastructure may also be partly a function of the practice of shifting lines from off-road to on-road situations.

Off-road lines are generally less overt and have fewer potential viewers. Upon relocation or extension, the number of viewers is increased and aesthetic issues can be raised. Off-road to on-road relocation does not automatically induce a negative aesthetic impact as the scenic context might be less sensitive to impact or the design might successfully address potential impacts. The potential impacts are certainly increased for on-road installations.

The Environmental Board has found (Docket #771, Application 1R0869-EB, "CVPS and VTEL") in 2001 that "there are few intermittent areas without any utility poles and wires along Route 7 but poles and wires are a near ubiquitous feature of the Vermont landscape." They went on to find that "utility poles and wires detract from the natural beauty of the landscape." While these findings are consistent with general observations, the Board went on to conclude that the proposed project did not have an adverse impact in part because the area had previously had power lines and poles and the proposed action resulted in less poles, but consolidation of power and telephone services on higher poles.

Growth within areas already served by overhead electric infrastructure can induce additional visual impacts as lines are upgraded for additional capacity, new poles are added as the result of additional curb cuts or non-electric utility lines, pole heights are increased to accommodate additional infrastructure, or when other telecommunications infrastructure (e.g. repeaters and cellular antennas) are added to existing electric poles.

At some point, consolidation of services and increases in pole heights along a roadway may trigger an aesthetic impact.

Issue #5: Underground vs. Overhead

Act 250 also largely discounts any aesthetic impact if the line extension is located underground. Under EBR Rule 2A(12), underground corridors or portions thereof, are not included in the determination of "development" area if they are not in

Figure 10- Lake Street in Burlington prior to undergrounding.

"scenic areas" and would thus be non-jurisdictional, provided other criteria are not impacted. The problem is that there are few well defined "scenic areas" within the state.

Some areas, particularly where the scenic context is most sensitive (historic areas, pedestrian environments, spectacular vistas), benefit greatly from removal of or placement of electric lines underground. In other areas overhead line extensions can be placed sensitively and do not necessarily result in aesthetic impact.

Issue #6: Aesthetic "Costs"

A previous study by TJ Boyle and Associates completed for PSB Docket 5496 in 1992 suggested that direct electric utility extension costs were "incidental"[6] as compared to on-site septic systems or access to municipal services, views and site amenities, and the costs of road construction. The study suggested that site views and amenities ranked high and may be negatively impacted by overhead line extensions.

Underground utility installations have been justified in part by the need to improve the aesthetic qualities of the roadway, pedestrian or streetscape environment or to improve historic character. When federal funding for such projects is either unavailable or inadequate, the decision to continue with the project may result in taxpayers bearing additional costs.

Over time, however, the long-term maintenance of the infrastructure would transfer a portion of the "costs" for aesthetic benefits back to the ratepayers.

[6] TJ Boyle and Associates (1992), "Impact of Electric Utility Extensions on Vermont Settlement Patterns"

While other cost "externalities" have more quantifiable metrics (reduction in pollution, preservation of wetlands, reduction in emissions), scenic qualities are inherently more subjective.

Many other states considering policy on undergrounding have accepted the notion of aesthetic costs and benefits without attempting to quantify them in monetary units. The suggestion is that less visibility of distribution infrastructure is a positive societal benefit, regardless of direct cost.

The actual benefit may be localized and in some ways personal, but when aggregated by large numbers of viewers, it can become very positive. This appears to be the basis for some policies that promote maximizing benefit to the greatest number of persons.

Issue #7: Aesthetics and Utility Operations

It is clear that aesthetic issues are not the driving force behind the design of a line extension. While it certainly is a consideration, utilities appear to favor issues of safety, access and efficiency. These issues certainly have value and should be considered in policy. The West Fairlee case study, for example, illustrates this point; the original design was not context sensitive, although it "worked" from an engineering perspective. The final design also "works", but is perceived as more sensitive to the scenic context, although only three poles were moved.

While not all projects are reviewed under Act 250, the process of creating a new corridor appears to require that those most directly impacted by proposed line extensions be informed prior to initiation of construction. The need to secure

easements on private lands and the responsiveness of the utilities to customer complaints and requests appear to encourage dialogue. Smaller projects that do not fall under the umbrella of Act 250 or local review are addressed only when problems arise.

The utilities also provide opportunities to address aesthetic issues with customers and communities. Municipal utilities have direct relationships with other municipal entities (Planning Boards, Road Commissioners). Investor-Owned Utilities (IOU) and cooperative utilities report to customers, shareholders or cooperative members. Several utilities have standing citizens' panels to address operational procedures.

Some utilities have adopted consistent design standards, many using the CVPS model. Many have also commented on how on-road lines promote worker safety, higher service reliability and ultimately lower consumer costs. Accordingly, these factors should be considered in the review of the issues.

Utilities also have adopted vegetation management programs that, in part, must address corridor design on a case-by-case basis.

Section D: Land Use

Issue #1 – Location of Growth

Growth occurs as the result of diverse regulatory, market and physical factors. Where growth occurs is complex but access to electricity is certainly a part of the framework that supports it.

One issue observed with line extensions is their ability to contribute to the spread of development beyond traditional population centers. The following is noted:

- The availability of affordable electric power can enable the construction of new residences, industrial and commercial facilities and retail establishments. Without ready access to power, such development can be much less desirable.

- When a line is extended into a new area as the result of a single residential customer, a cell tower, or an industrial user, the development climate along that extension may be improved.

- When other limiting factors for growth have been met (sewer, water, access) and when market and economic pressures reach a threshold, the economic benefits of extending service and initiating development can outweigh the costs. It can be the "straw that breaks the camel's back".

- Same-corridor relocations or reconstruction have less potential impact on the location for growth. Once power has reached an area, more subtle modifications to the line will tend to alter the overall development climate less.

- The potential impact on land use is proportional to the length of the extension. The longer the extension into undeveloped areas, the greater the potential to influence the development climate.

Issue #2 – Pattern of Growth

How actual development along the extension corridor occurs can also be affected by the extension itself. As observed in West Bolton, the service drop credit of 100 feet may help set the position of house sites.

Roadside extensions may encourage narrow frontages or minimal setbacks and discourage more clustered patterns. Other factors such as zoning, site development characteristics (topography, wetlands and streams), access to transportation infrastructure and access to water and wastewater also have a very profound affect on the pattern of growth and generally dominate.

The grid form of streets typical of urban centers is well supported by a pole and line (or vault and conduit) form of distribution system. Higher population densities are enabled in part by the availability of electric utility infrastructure.

The line extension process also has supported the rural development patterns, albeit in a different way. The growth of farming and the traditional agriculture as we know it today was encouraged by the extension of electric service through the Rural Electrification Act of 1936 (7 U.S.C. 901-950b). The provisions of the act, made at the heart of the Great Depression, were to help wire the rural portions of the nation. The cooperative utilities contributed greatly to this process. Obviously the economic viability of agriculture relies on access to power. There are many examples in the state of cross-country distribution lines serving a series of valley floor farms. Although this creates a low line density design, it was and still is considered an essential economic development policy.

Issue #3 – Local, Regional and State Response to Extensions and Land Use

The current number of "pure" line extensions projects reviewed under Act 250 per year is very low. This provides little opportunity for any substantive discussion of the impacts of such projects on land use, settlement pattern or community development. There have been a limited number of District Commission and Environmental Board cases such as Washington Electric #5W1036-EB, Central Vermont Public Service Corporation and Verizon New England 2W1146-EB, and Central Vermont Public Service #2S0301 where the Board and the Commission have recognized the connection between land use changes in the form of growth and the effect of this change on natural resources and the community.

Act 250 reviews also occur as part of other development projects, but the larger aesthetic and land use issues of extension and their incremental ability to influence the climate of development may not occur.

Many communities have adopted policies and ordinances addressing the extension of electric service. In many cases these policies are geared towards the requirement for undergrounding. Historic patterns of overhead installations in back alley settings should be encouraged.

Public utility projects are often handled as a minor application, subject to the review of the local zoning administrator. While town plans and regional plan do have language regarding placement of distribution lines, such language is not a prohibition. These documents essentially encourage the

Figure 11- Urban overhead lines placed in the "back alley" in the Village of Essex Junction

minimization or mitigation of impacts. This was noted by during the West Fairlee case study. Some, like Charlotte, encourage undergrounding and reuse of existing corridors.

Any public process, including Act 250 or town review, would have a noticed public hearing and comment period. This does provide an opportunity of the airing of issues. It does not appear that these local reviews have raised significant issues. CVPS, for example, indicated that it had several towns that demand more coordination, but in general the relationships are mutually positive.

Issue #4 – Effect of Extension Costs on Settlement Pattern

The cost of the line extension is borne by the developer or customer requesting service. This can be a substantial investment in the tens of thousands, depending on distance and design issues.

It appears that the service drop credit may be playing less of a role in the determination of land use and settlement patterns than the 1992 TJ Boyle reported. That report observed that the setback of houses in Charlotte and Addison appeared to follow the service drop distance of 100'. We also observed this in older developments in West Bolton, but it may not be the case for more recent development. Numerous examples of clustered or even conventional subdivisions of recent vintage with underground service were observed. These were also found in places as geographically diverse as Fairfax and Pittsford.

Positive benefits of the service drop credit to promote development closer to the roadway may have been lost as; 1) the amount of the credit is small relative to other land costs and 2) other installation forms became more affordable.

The use of 3rd party contractors for excavation, setting conduit and even laying conductor and the economies of conducting all of this work concurrent with site excavation, may be lowering the threshold for the use of undergrounding. Also, many communities have adopted subdivision ordinances requiring underground installations in new subdivisions.

Issue #5 – Operational Issues and Land Use Impacts

The utilities have indicated that the relocation of off-road lines to on-road locations is partially the result of seeking

higher system reliability. Often, this relocation is to regain efficiency that was lost from reforestation, road realignments, etc. In the process this may again improve the development climate, particularly if the relocation is from a great distance away.

Rural line extensions may have the biggest impact on the operations of the electric utilities. Some of the lines seen in West Bolton, for example are located in very inaccessible areas with obvious maintenance issues. It would seem that from a system management perspective some of these lines, particularly with such low density, are very inefficient. Long, rural extensions serving single or few users would seem to be contrary to efficient system design.

Section E: Environmental

As discussed in the introduction to this part of the report, the environmental issues associated with line extensions are considered to be mainly natural resource related.

It appears that most distribution line extension have a limited potential for significant direct environmental impact. The consultant team could find no decisions of the Environmental Board or other review agencies citing a case where environmental issues alone resulted in denial of a permit for a distribution line extension. In our review of other cases in other states the issue of EMF was raised as a concern, but generally was given little significance. It was also clear that the existing permit infrastructure for environmental approval is significant (local permits, Act 250, Army Corp of Engineers, NEPA, etc.). Wetlands issues, for example, may be reviewed by localities, the State (VT Wetland Rules), or by federal government under Section 404 of the Clean Water Act.

This is not to say that distribution line extension projects do not have the potential for direct environmental impacts, they do. But when compared to aesthetic and land use issues, however, the policies presently in place to protect environmental resources appear to address these potential impacts.

As discussed in Section D, electricity is part of the framework that supports the development climate. Any induced or secondary growth of new residences, industrial and commercial facilities and retail establishments, enabled in part by electrical service, has the potential to affect natural resources and environmental quality. Scattered residential development in rural areas may affect soil erosion, water quality, wildlife habitat (by consuming and fragmenting habitat) and forest management, (through subdivision of large lots into small lots that are impractical to manage for forest resources).

Section F: Costs

Several analyses were completed to evaluate the costs for line extensions. The direct costs (capital, operations, maintenance) of line extensions in various forms were provided by three basic utility types (municipal, cooperative and IOU). Each utility type was asked to participate in two separate costing exercises.

- Preparation of cost estimates on a hypothetical tap line extension to a single-family home located roughly 900 feet off a Class III road.
- Submission of estimates of line extension costs for single-phase, tap line and main line installations. For each of these installations, they were asked to consider both overhead/underground and on-road/off-road development forms as well as operations and maintenance costs.

Hypothetical Case

A conceptual site plan of a proposed single-family home set back about 900 feet from the edge of a winding road was created (Figure 12). Each utility was asked to prepare two options to provide single-phase service from the main road. One option was least-cost overhead and the other was underground installation.

The site plan provided also included some challenges designed to test how utilities would approach the installation from an operational basis. The driveway was curved through woods and wetlands and large outcropping of rock challenged access to the house site from the north.

Least-Cost Overhead (Concept A)

For the overhead concept (See Appendix 2) the request of the "owner" was to do as little clearing as possible. Both VEC and

Figure 12- Hypothetical line extension

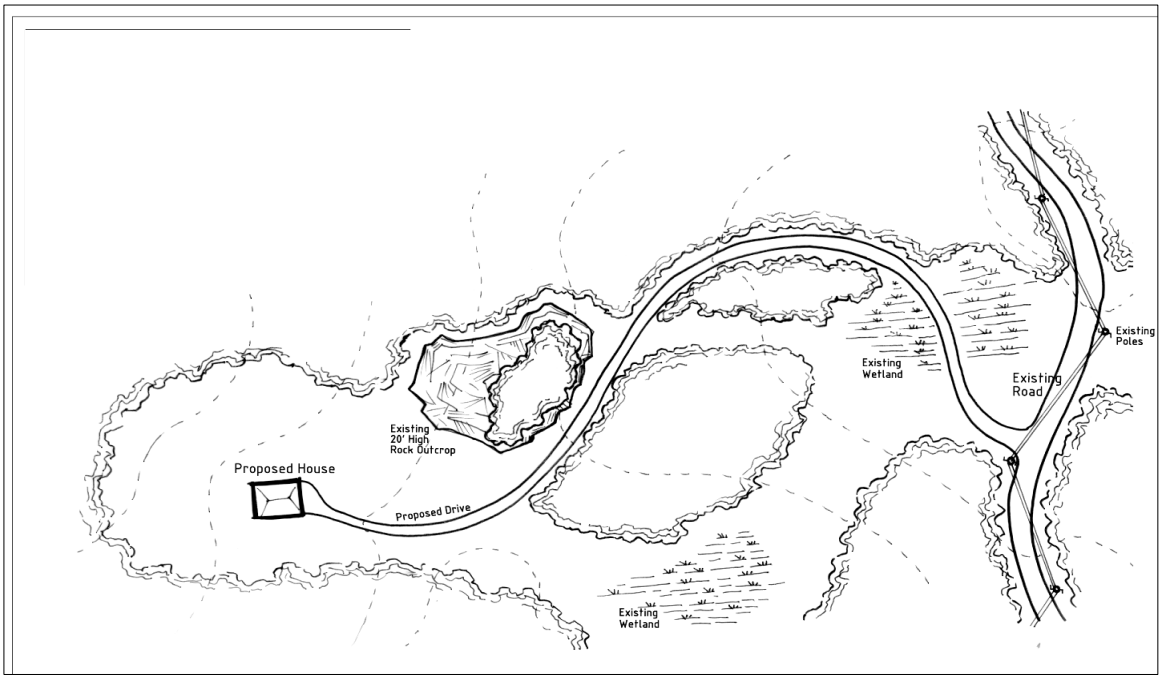


Table 5: Summary of Designs for Overhead Line Extension Hypothetical Case Study

Parameter	VEC	CVPS
Number of Poles	4	5
Total Length of Service	1280'	1300'
Max Distance Between Poles	320'	275'
Min Distance Between Poles	250'	100'
Primary Pole Costs	$2,513.00	583.00
Additional Poles	$6,131.00	$1,292.00
Conductors/Laying Costs	$1,003.20	$3,090.00
Underground Service (A)	$572.00	----
Service/Application Fees	---	$345.00
Trimming/Outcrops	---	$2,210.00
SUBTOTAL	$10,219.20	$7,520.00
Less Service Prop Credit	-$631.00	-$210.00
Plus Tax Assessment (B)	0.00	$2,543.88
TOTAL Line Extension	$9,588.20	$9,853.88
Cost/Lineal Foot	$7.49	$7.58

(A)The design proposed by VEC included a 200 foot underground service to the residence

(B)Investor-owned utilities charge this tax assessment per the IRS at a rate of 34.80%.

CVPS prepared designs and estimates that followed the alignment of the driveway, presumably to make access for maintenance easier. The CVPS design had 5 poles total with poles 4 and 5 placed so that the access drive would have little visual impact. The VEC design had 4 poles total with the last 200 feet of service provided as underground.

Burlington Electric Department did not prepare an overhead estimate or design as the City of Burlington zoning and subdivision ordinances require new residential hookups to be placed underground. The franchises of VEC and CVPS include towns with and without these requirements.

The direct costs between CVPS/VEC are similar, from the customer's perspective. The IRS gross-up tax assessment charges however add substantially to the CVPS estimate and account for $1.96/lineal foot of the total costs.

Both CVPS and VEC cited direct access to the lines as a reason for placing the poles along the driveway. Both designs have some potential aesthetic conflicts; the CVPS design includes poles and overhead connects right to the house, the VEC plan has a riser pole 200 feet from the house that would have a visible transformer, etc. From the main road, both designs would look very similar.

Underground (Concept B)

The underground installation option had four responses from the utilities. Both BED and CVPS made estimates based on extensions of about 900 lineal feet. BED did not provide a graphic or detailed breakdown of the design. VEC provided two underground options; the first a more

Table 6: Summary of Designs for Underground Line Extension Hypothetical Case Study

Parameter	VEC 1	VEC 2	CVPS	BED
Length of Conductor	1080'	1300'	1090'	900'
Number of Vaults	2	2	2	N/A
Max Distance Between Vaults	530'	510'	140'	N/A
Min Distance Between Vaults	200'	200'	140'	N/A
Conductor Costs	$4,696.00	$5,671.00	$2,556.45	$16,200 (A)
Transformers/Vaults etc.	$1,534.00	$1,534.00	$3,720.00(B)	$4,500.00
Trenching/Conduit Labor (C)	$4,017.60	$4,836.00	$3,534.00	N/A
Poles/Risers	$910.00	$910.00	$1,390.00	N/A
Other Fees	---	---	$622.00	N/A
SUBTOTAL	$11,157.60	$12,951.00	$11,822.45	N/A
Less Service Prop/Customer Conduit Credit	($631.00)	($631.00)	($651.75)	N/A
Plus Tax Assessment	---	---	$3,887.40	N/A
TOTAL Line Extension	$10,526.60	$12,320.00	$15,058.10	$20,700.00
Cost/Lineal Foot	$9.75	$9.48	$13.81	$23.00

NOTES:

(A) BED estimates combined all costs into a single line item. The estimate was based on $18.00/lineal foot, not including a transformer mounted on a "Nordic Box" or running primary wire.

(B) CVPS' estimate included more detailed breakdown of costs for transformers, including foundations for pad-mounted transformers ($1,530.00)

(C) VEC did not provide customer charges in the estimate for installation of conduit, trenching, etc. We have used the CVPS' estimate of $3.72/lineal foot for this work. CVPS' estimate did not include the 140' service from the pad-mounted transformer to the structure.

direct route similar to that of CVPS, the second option is placed along the access drive. Presumably, this option could be advantageous to the customer if the extension is completed concurrent with the construction of the access drive.

A major consideration in the underground option is that a portion of the costs of the line extension will not be billed by the utility, but by the contractor responsible for excavation and trenching. Unlike overhead service, the customer or 3rd party contractors do some of the work required for underground tap line extensions.

BED indicated that in its typical case, the customer's contractor would trench, install conduit from the nearest pole to the meter channel. BED would then pull the wire (supplied by the customer), build a riser and make the connections. They would normally not charge for this as it is not a primary service extension. CVPS estimated trenching costs could be nearly 25% of the overall costs[7]. This would obviously depend on the site conditions.

VEC and others have noted that they prefer to be out of the excavation business. As

[7] $3,720 for Trenching / $15,058 Total Costs = 24.7%

the customer can shop around for an excavation contractor, the possibilities for reductions in cost can be realized. The interview process and observations in the case studies suggest that many consumers are taking advantage of undergrounding for this reason.

Summary

The two hypothetical cases provide insight into the direct costs of single-phase line extensions. The differences between the three utilities, although not surprising, is probably attributable to several factors:

- The intensity of the analysis for the case – some utilities conducted and provided a more detailed estimate of costs.
- Differences in experience or the environment of the franchise – BED, for example, did not provide an estimate for new overhead extension; they are not allowed to do such work by city ordinance. VEC specified the use of tree wire in its overhead installation.

All that being said, it would appear based on this example, that the following is seen for overhead extensions:

- $7.49 - $7.58/lineal foot
- VEC was $0.09 less per foot than CVPS
- Tax Assessment adds $1.96 to the cost of the extension for CVPS
- The VEC service drop credit is $631.00, while the CVPS credit is $210.00. These credits, however, are small in comparison to the net costs of the extensions and represent at most 6%. Any slight changes in the amount of the service drop credit would have little impact on the overall cost or affordability of the extension.
- VEC did not indicate any tree trimming or bedrock removal costs, CVPS did.
- The VEC estimate for poles was much higher and presumably accounted for costs of laying, etc. CVPS figures were more definitive as to the type of expenditure.

In all, the costs appear to be within the same general area, special tax assessments not withstanding.

Underground costs, by comparison, had a much greater variability in this analysis. The range was between $9.48/lineal foot and $23.00/lineal foot. The most expensive estimate was by BED, probably reflecting the higher costs of work on urban environments. The hypothetical case, by all admissions, is not typical of urban settings. CVPS' estimate was mid-range at $13.81/lineal foot. As stated previously, the actual billed costs from the utilities may be much smaller if the costs of conduit, trenching, and conductor are secured through 3rd parties.

The following is noted for underground cases:

- The conductor costs for VEC were much higher than for CVPS ($4.43/foot vs. $2.20/foot)

- VEC did not provide estimates for customer trenching, conduit, etc. The CVPS estimate did. It is likely that the costs of this work will vary considerably depending on site conditions (soils, bedrock, access, etc.) and by location (more expensive in Chittenden County, less in Essex County). These

services represented about 25% of the total costs for the underground extension.
- IOU tax assessment charges add another significant amount to the overall costs.

Comparing the direct costs of underground and overhead installations for VEC and CVPS shows:

- VEC estimated that underground costs are approximately 1.25 to 1.30 times the cost of overhead costs.
- CVPS' estimate puts the differential costs for undergrounding at 1.82 times.
- Site conditions potentially play a pivotal role in determining the design and costs. A difference of $0.27/lineal foot or $1,793.40 was noted when comparing the roadside and cross-country underground options prepared by VEC.
- Direct cost represents only a part of the potential costs for a customer. If the project requires Act 250 permits, Army Corp Wetlands Permits or special site issues, these costs could be considerable.
- The analysis did not include any redundancy, as a single customer is generally not required to pay for a loop feed system. The additional costs of a loop feed can be relatively inexpensive, depending on geography and the design. Multi-family developments would likely be required to build in this redundancy.

Utility-Provided Cost Information

In addition to the hypothetical case study, the consultants sought additional information on the direct costs of line extensions from the three major utility types (IOU, municipal and cooperative). CVPS provided an outline and analysis of the net present value (NPV) for various configurations of line extensions.

The data collected was based on approved line extension tariffs, past experience and project data, utility engineering estimates, maintenance records and some judgments. The utilities indicated that records of costs are not stored by type of land use. BED probably has the most "pure" information, as nearly all of its franchise could be considered urban[8].

The quality of this data is not completely known and should be treated with some skepticism. The approved tariff and unit cost data should be reasonably accurate as they are the basis for both estimating and ultimate billing of line extension projects. Long term maintenance data is based partly on budgeted amounts for tree clearing, right-of-way management, etc. Actual annual expenditures could be different.

Investor Owned Utility

CVPS provided capital and operations and maintenance cost data for distribution line extensions. They have provided ranges for costs, due to the high degree of variability in new line extension construction, etc. They assumed that the life cycle for both above and underground systems is 50 years and have factored in estimates of Operations and Maintenance (O&M) costs.[9]

[8] Phil Morse, CVPS, 5/2/2002
[9] BED (telephone conversation w/ John Askew, July 2002) indicated that it has been their experience that a 30-year life cycle is more consistent with the infrastructure and in keeping with previous interactions with the Public Service Board.

For overhead lines CVPS has provided the following range of estimates for capital costs:

Single Phase On-Road	$8.00/ft -- $13.00/ft
Single Phase Off-Road	$10.00/ft -- $17.00/ft
Single-Phase Underground	$10.00/ft -- $38.00/ft
3-Phase Tap Line On-Road	$14.00/ft -- $24.00/ft
3-Phase Tap Line Off-Road	$18.00/ft -- $30.00/ft
3-Phase Tap Line Underground	$30.00/ft -- $55.00/ft
3-Phase Mainline – On-Road	$20.00/ft -- $40.00/ft
3-Phase Mainline – Off-Road	$30.00/ft -- $50.00/ft
3-Phase Mainline – Underground	$50.00/ft -- $150.00/ft

Within these capital costs ranges CVPS included estimates of looped and radial configurations for underground installations. They also did include the costs of trenching and conduit in the estimates. CVPS stated that these estimates do not include the IRS gross-up charge (34.5%) that is typically charged. For the consumer, this additional fee increases the cost range significantly. A final analysis of costs does examine the impact of this gross-up charge. Public utilities do not charge this tax.

Data presented do not include costs for acquisition of easements that could be substantial for off-road installations. On-road lines will typically have access to the public right-of-way. The costs also do not reflect any special permitting, temporary aerial relocation or other provisions that can impact the overall cost.

The operations and maintenance costs provided by CVPS show how the various types of line extensions are operationally managed. Off-road lines have 1.28 to 2.0 times the long-term O&M costs as compared to on-road lines of the same type. The largest difference was in single-phase lines, possibly due to the fact that many single-phase lines do not have high levels of redundancy. Thus, when a single-phase off-road line goes down it will take longer to fix and cost more to access. It would appear that the differences in O&M cost in part reflect this (Table 7).

Underground lines were shown to cost substantially less than overhead lines in terms of O&M. The ranges go from 1.88 to 3.75 times less for single-phase; 2.27 to 2.91 times less for 3-phase tap line and 1.69 to 2.46 times less for 3-phase main line installations. Clearly they are more reliable. The upfront capital costs, however, were nearly 4 times than equivalent overhead installations.

CVPS calculated the average cost for maintenance on overhead lines at

Table 7 – Summary of CVPS Capital and O&M Costs

Configuration	Costs per foot	
	Capital Costs (min-max)	O&M Costs (min-max)
Single Phase On-Road	$8 - $13	0.15
Single Phase Off-Road	$10 - $17	0.30
Single Phase Underground	$16 - $38	$0.08 – 0.11
3-Phase Tap Line On-Road	$14 - $24	$0.25
3-Phase Tap Line Off-Road	$18 - $30	$0.32
3-Phase Tap Line Underground	$30 - $55	$0.11 - $0.13
Main Line On-Road	$20 - $40	$0.22
Main Line Off-Road	$30 - $50	$0.32
Main Line Underground	$50 - $150	$0.13 - $0.15

$1,186/mile or $0.22/foot (Based on maintenance budgets). Underground lines were calculated at $531/mile on $0.10/foot. In these terms the cost of underground operations and maintenance is roughly 45% of the cost for overhead.

Municipal Utility

Burlington Electric Department provided estimates of the capital costs for utility line extensions on a dollars per foot basis using their work order system (unit costs) and past actual site work costs. They provided 20% contingencies on either side of an average value to account for the many variables that may impact cost (Table 8).

BED based their costs on workflow analysis and unitized it on 500' average extensions. In subsequent conversations with John Askew (BED Engineering Services) they indicated that in their experience, a 30-year life is more typical and in keeping with PSB protocols. BED also indicated that the O&M costs over the 30-year life cycle are generally small when compared to capital expenditures. BED suggested that the upfront, high capital costs are what must be addressed.

BED did not provide off-road costs. Most of the municipalities' lines are on-road, as would be expected in an urban environment. John also indicated that approximately 70% of the system is overhead although more than 50% of the capacity is handled by the underground system in the greater downtown area.

The data for BED suggests that the cost for undergrounding main line extensions could be as high as 13 times an equivalent overhead design.

As the Main Street case study showed, these numbers do not include some significant items that can dramatically increase the per foot costs. For example:

New Switch	**w/Protective Functions**
-Overhead:	$19,250 to $28,860 each
-Underground:	$70,000 to $105,000 each

BED also indicated that the costs for underground ductwork alone can run as much as $60.00/foot of circuit. Costs do include City of Burlington excavation fees, traffic control, parking meter purchases, etc. The BED estimates also show the influence of working within the street right-of-way. For 3-phase tap lines the costs more than double. This is due to increased costs for excavation, traffic, fees and coordination, etc.

Table 8- Summary of Line Extension Capital Costs - BED

Configuration	**Cost Per Foot**		
	Min	**Average**	**Max**
Single Phase Overhead	$7.80	$9.75	$11.70
Single Phase in row Underground	$63.00	$79.00	$95.00
Single Phase outside row underground	$29.00	$35.00	$42.00
3-Phase Tap Line Overhead	$11.60	$14.50	$17.40
3-Phase Tap Line Underground In Row	$65.00	$83.00	$100.00
3-Phase Tap Line Underground Outside Row	$31.00	$40.00	$48.00
Main Line Overhead	$14.00	$17.00	$20.00
Main Line Underground	$125.00	$155.00	$185.00

Cooperative Utilities

Washington Electric Cooperative (WEC) and VEC were asked to provide similar information as CVPS and BED. VEC did not provide information stating that getting access to such data was very difficult. Washington Electric Cooperative provided data on the average overhead capital cost and budgeted maintenance data.

WEC provided only single-phase on-road overhead cost data[10]. They indicated that in any given year they will construct five extensions of greater than 5 poles and that the average cost for construction is $8.25/lineal foot. The average line extension is 2 poles or 560 feet.

WEC indicated that of its 1,233 miles of network approximately 60% is off-road (740 miles). It also indicated that they spend $351,000 annually on maintenance of overhead infrastructure. They indicated that on-road installations have 33% less maintenance costs than off-road lines. Using the annual budget numbers, the average O&M costs for off-road lines is $0.06/foot while on-road lines are $0.04/foot.[11] These numbers are much lower than similar estimates from CVPS or BED.

Summary

The information provided by the utilities, although in slightly different forms, does provide a range of numbers to reflect the magnitude of direct costs for overhead vs. underground and off-road vs. on-road line extensions. A number of conclusions can be drawn from these data:

- Single-phase extensions are the least costly whether overhead or underground. Underground installations would generally have a substantial amount of the work (and cost) completed by 3rd party contractors.

- Off-road line extensions may have slightly higher upfront capital and O&M costs than on-road extensions. The differences are not orders of magnitude.

- 3-Phase Mainline underground is more expensive than overhead options. The estimates provided also do not factor in many of the technical elements needed for subsurface systems. BED, for example, provided a mainline range of $125/ft to $185/ft. The Main Street case study showed an actual realized cost of $247/ft (less duct work). The difference in these numbers may be that the Main Street project, like some other relocations (on-road to underground) required a temporary aerial line, which in that case cost $58/ft.

[10] Telephone conversation w/ Dan Weston – November 2002. According to Dan, Director of Operations & Engineering, WEC is roughly 90% residential and has not done a 3-phase extension in over 5 years. 3-Phase is not common in the franchise. Additionally, WEC indicates that they make great efforts to locate along or adjacent to public roads.

[11] WEC annual budget is $351,000. According to WEC off-road costs are 2/3 of the maintenance costs or $233,999. Of the 1,233 miles of overhead network, approximately 740 miles is off-road (60%).

While the utilities provided some useful information on the capital and O&M costs of line extensions, an additional set of analyses was conducted to unify the data. The Net Present Value has been determined using capital and O&M costs based on a 30-year life cycle and at a discount rate of 5.48% and an inflation rate of 3.0%[12]. These rates are keeping with the consumer price index and inflation trends based on the US Treasury.

The results (see Table 9 on next page) show the evaluation for single phase, three-phase tap and three-phase main line installation type. These estimates are based on averages and has been indicated previously, can change dramatically based on site conditions, underground ductwork requirements and other construction variables.

[12] Inflation Rate - in general, we feel that a going forward inflation rate of 3.0% makes sense, rather than the 2.5% figure used in the CVPS analysis. This is based on actual inflation rate data for the past few years, drawn from Consumer Price Index (CPI) data. (Source: Federal Reserve Bank; Boston). For the past three years, the average annual inflation rate was 2.81%. For the past two years, the average annual inflation rate was 3.11%.

Discount Rate - this figure is more variable and is somewhat dependent on the investment objectives of the analyst. However, we would normally use the current rate for the 30 Year U.S. Treasury Issue for a 'generic' analysis. The rate as of 7/2/02 was 5.48%

TABLE 9: Line Extension Costs - Net Present Value Analysis - Summary

Discount Rate:	5.50%
Inflation Rate:	3.00%

Installation Type	Utility Average Capital Costs ($ / foot)	Average Annual O&M Costs ($ / foot)	Net Present Value Total ($ / foot)
On-Road			
Single Phase	$9.50	$0.11	$11.36
3-Phase Tap	$14.38	$0.25	$18.76
3-Phase Main Line	$23.50	$0.24	$27.10
Off-Road			
Single Phase	$10.38	$0.18	$13.53
3-Phase Tap	$24.00	$0.31	$29.11
3-Phase Main Line	$40.00	$0.32	$44.48
Underground – Radial			
Single Phase	$22.04	$0.08	$22.53
Underground (looped)			
Single Phase	$50.75	$0.11	$50.26
3-Phase Tap	$62.50	$0.11	$61.50
3-Phase Main Line	$127.50	$0.12	$123.26

Note : Underground costs do not include any special vaults or other control equipment. In urban areas where complete undergrounding is required, these costs can be substantial.

The use of the looped system figures submitted by BED is assumed to be equivalent for work within the ROW. Work outside of the ROW is assumed to be more typically radial.

Ranges within estimates can be +/- 20 to 30%.

From this background research into costs, several issues arose that might be considered in future policy.

Issue #1 – Underground vs. Overhead Direct Costs

The cost of underground installations for main lines was high. BED indicated a range of $125 to $185 per foot. Adding to this ductwork costs of up to $60 per foot puts such projects in the range of $185 to $255 per foot. Working on large-scale highway projects also appears to add some complexity to the projects. It is conceivable that true mainline installations could be well over $300 per foot. The NPV analysis only provides averages. It is clear that the range can be variable and very site specific.

The NPV analysis of cost data also showed an increase of roughly 2-3 times for maintenance of overhead installation vs. underground.

A recent study by the American Public Power Association indicated that nationally, investor-owned utilities roughly 63% of the maintenance budget is set aside for overhead line maintenance (tree clearing, trimming, etc)[13]. The study recognized that there is a high degree of variability by franchise and this would impact budgets. The same data also indicated that overhead maintenance is up to 9 times more expensive than for underground.

One reason for the differences between national data and information provided by Vermont utilities may include the relatively small amount of underground infrastructure. Also, the national data has been aggregated for a large number of utilities. The lack of reporting by Vermont utilities to requests for data is also a factor.

PG&E as part of its implementation of the California Public Utility Commission's Rule 20, suggests a estimate of $1,000,000 per mile or $190/foot[14] for underground main line relocations. With 30 years of relocation work completed, this number appears well supported. It is also very consistent with the upper estimate for main line undergrounding from BED.

Because of all this variability, when considering a policy of underground vs. overhead installations, recognizing the site specific nature of the costs is important. The consideration of costs should include all customer charges (including 3rd party excavators) for an extension. The decision a landowner makes to extend service is based on all the costs, not just on charges from the utility. Unfortunately, estimating trenching costs in advance of an actual design plan is nearly impossible given the variability of site conditions.

Issue #2 – On-Road vs. Off-Roads Direct Costs

An examination of the data suggests that on-road vs. off-road costs are not significantly different, particularly for residential phase 1overhead extensions. Although CVPS indicated that O&M costs for off-road lines were nearly 2 times higher, WEC estimated roughly 1.3 times. The NPV analysis shows an averaged difference of about 1.19 times over a 30 year life cycle. This suggests, at least preliminarily, that costs between off-road and on-road overhead extensions are not significantly different.

[13] Kwoka, John E. "Electric Power Distribution Costs: Analysis and Implications for Restructuring" APPA, February 2001.

[14] "Undergrounding Public Utility Lines", *Hawaii Public Utilities Commission*, 2000.

Once again costs considered in policy should include all customer charges needed for the extension. When a landowner makes a decision to open property up to development and invests in infrastructure, the costs will include trenching, etc. These costs can only be determined after design and review of the site conditions.

Issue #3 – Valuing of Externalities

Currently the policy for cost recovery of utility distribution line extension requires that the person(s) requesting the service bear the full cost of the extension. While these tariffs do account for direct (construction and labor) costs, they do not account for cost externalities that may result.

The possible loss of visual quality or the acceleration of residential growth resulting from a line extension or relocation may be real. Quantifying it in monetary form is more difficult.

Willingness-to-pay methods, such as those conducted for the Vermont Scenic Byways Program, can provide some basis for assessment of how much value is placed on streetscape without power poles. Any assessment would need to be broad enough to address a variety of contexts (urban, suburban, and rural) and various line forms. Because the standards for line design can vary around the state establishing a fair comparison uniformly for all areas will be difficult. For example, suggesting one type of design in Burlington may make no sense in Monkton.

A review of willingness-to-pay methodologies completed by the Centre for International Economics[15] suggested that the most appropriate method for measuring service quality (reliability) is Choice Modeling. In this technique, a series of questions is provided to respondents who must choose between 3 or more scenarios. The choices compare various forms of reliability as described in terms of how many minutes a year that you are out of service, the total number of outages, the type of power (underground or overhead), etc. A surcharge to the power bill for each choice provides the monetary underpinning.

Most discussions on the external costs associated with line extension appear to be centered on the issue of overhead verses underground. The two forms reflect stark contrasts from an aesthetic perspective. The visual difference between an on-road alternative and an off-road alternative may not be that striking.

Issue #4 – Distribution of Costs and Benefits

We have considered two major economic forces during our evaluation of the costs and benefits of various line extension forms:

- Efficiency – Net contribution to society
- Equity – How well the benefits are distributed

The efficiency of a project can be measured by how much benefit is reached as the result of an action versus how much it costs. The costs and benefits may be more readily quantifiable (lower maintenance cost, reduced utility bills) or more

[15] Costing Methodology for Electric Distribution System Planning, The Energy Foundation (2000)

qualitative (improved views, protected historic sites). The true ultimate cost of any line extension project is the combination of both quantitative and qualitative elements.

The overall efficiency of an alternative can be described in one of two basic ways:

- Pareto Improvements – Those actions where benefits are realized by some but the rest of society is not impacted.

- Potential Pareto Improvements – Where those who benefit from an action gain more than those who lose from the action.

Both of these measures are relevant to the line extension issue. Currently, tariffs for line extensions place the costs of the extension on those requesting it. At first glance, this appears to be a highly efficient system – a person pays for service they require, they receive power and its benefits and others are not directly assessed costs for the extension of services. Some may consider it a Pareto Improvement.

This conclusion fails, however, when long-term costs, externalities and public funding mechanisms are considered. The long-term operations and maintenance costs of any new extension become a cost shared by all those within the utility franchise through the service tariffs. Line extensions that promote system redundancy or add considerable numbers of customers would seem to provide some net benefit. All customers benefit from increase reliability and scale economies may promote greater efficiency in the use of utility resources.

Extensions that serve single customers on long extensions would appear to offer less potential benefit to the overall customer of the utility. These types of installations would typically be in more rural areas where potential for outages are higher, where customer density is lower and where the dangers of line management are higher.

The visual impact of an on-road overhead line extension might affect a larger number of people, but the direct benefits of the work could only affect a few customers. Likewise, any impact of a line extension on enabling future growth to occur could affect the entire community, but only one customer may enjoy the direct benefit.

Public funding of utility line relocations occurring as part of transportation improvement projects also impacts the efficiency of the current tariff. The benefits of the project (better pedestrian character, historic sensitivity, improved reliability) are potentially realized by only a few while a portion of the costs are borne not only by those requesting or receiving service, but by all taxpayers.

Because of these other considerations, it does not seem likely that a line extension project could achieve Pareto status. No matter what form an extension takes, there is some impact to society. The real test is whether there is a net positive benefit from a line extension project factoring in all external costs.

Equity deals with how the costs and benefits are allocated to society and the degree to which those in advantage receive a disproportionate benefit. In the case of distribution line extensions, there appears to be several factors at work.

The West Fairlee line extension previously discussed was done, in part, to improve system reliability, benefiting all customers of the utility. All customers of the

franchise paid the cost of the work. The external costs were mostly localized to the area of work. The project was in a sparsely populated area that already had access to power.

It could be concluded that the benefits (higher reliability, less worker safety concerns,) realized by all of the franchise outweighed the costs of local external impacts.

It should also be emphasized that a cost to consumers may also be changes in property values. We have not completed a detailed assessment of the impact of distribution line extensions on property values. In our literature review we could not find a study such as this; many studies have concentrated on the impact from transmission lines. The fact is that most property benefits from having power. We have heard of discounting in sale prices for homes that were not connected to the grid and difficulties in securing loans for such properties. Similarly it is generally accepted that properties with power will sell at a higher price. A cursory review of real estate listings noting land with available power shows this premium.

New home construction in many parts of the State has underground service connections. We observed underground connections from service drops to new and older homes in many locations (Fairfax, Hinesburg, Pittsford, and Fairlee). The West Fairlee case even indicated that someone would pay 2x the costs for underground. There may be a growing willingness to accept underground connections, particularly as some costs have shifted to 3rd party contractors who can efficiently add service along with other site infrastructure. The fact that many local subdivision and PRD permits require underground connections also must be noted.

Section G: Operational, Management and Reliability Issues

While the analysis of direct costs is helpful in the evaluation of the line extension issue, we must also carefully consider the operational and maintenance activities that these costs include. While it may be easy to dismiss O&M costs as they are only a fraction of the capital investment, issues of safety, reliability and system capacity are real and have a profound impact on the customer, utilities and the general public.

Issue #1 - Safety

All of the utilities interviewed for this study have identified the needs for safety as an important consideration in the line extension issue. Electric utility work is a very dangerous profession. The National Electric Safety Code (NESC) provides the guidelines for protecting utility workers during the installation of conductors and other infrastructures. It also provides the code for how installations should occur to protect the general public and property. Both aspects of Safety are important to consider.

Worker Safety

The United States Department of Labor's Bureau of Labor Statistics found in the 2000 Census that 81 fatalities occurred in the performance of electrical work.[16] Of these deaths, 44% were due to exposure to harmful environments. The rate of injury is 8.2 per 100 workers, with about one-half of injuries requiring days off.

The two safety factors most mentioned in discussions with utilities were:

- Working on "hot" poles – using hot sticks from bucket trucks,
- Confined space entry requirements for underground vaults – interactions with water in subsurface environments.

Both of these situations relate to performing maintenance on "live" extensions. Working on poles "hot" requires very specific equipment and ready access to the overhead line by a line truck. The utilities suggested that, in addition to reliability gains, moving lines off-road to on-road would increase worker safety. Clearly working from the safety of a line truck does have the potential to reduce the possibilities of electrocutions and other potential injuries.

BED also relayed comment that underground utilities; particularly main line type installations have significant potential for accidents. The NESC provides considerable guidance on the matter, but some vaults have chronic water problems, exasperating an already dangerous situation. The reality is that both overhead and underground lines have very real maintenance hazards.

Public Safety

The electric distribution system also has the potential to interact with the public in undesirable ways. Literature review and discussions with the utilities and others have suggested the following major pathways to such interactions:

- Vehicle/Pole collision
- Touching lines with ladders, antennas, kites, etc.

[16] Bureau of Labor Statistics, Table 1 – Incident Rates – Detailed Industry Level – 12/18/01

- Interactions with lines from climbing or tree trimming.
- Construction excavation activities

The above pathways are well addressed by the industry and government. The Dig-Safe Program helps reduce potential conflicts from excavation activities; the utilities promote public safety programs and educational programs as do some insurance companies. While all of these programs must help reduce potential impacts, the public continues to have dangerous encounters with the distribution network.

Automobile/pole interaction is one area where public attention does not appear to be focused. Current design standards do, in part, considered the safe zone for an automobile. This issue, raised during the first workshop for the study, is currently being considered by VAOT as it reviews its accident-monitoring program. Getting reliable statistics on the types of accidents and where they occur relative to electric distribution infrastructure is an important step. It is only logical to conclude that as the percentage of the distribution system that goes from off-road to on-road increases, the number of accidents involving a power pole will increase.

VAOT has indicated that they do review on-road installations and have set requirements for setbacks that reflect, in part, the issue of safety. They also indicated that power poles are only one of many roadside hazards and that if they are removed, the hazard may become something else, (tree, guardrail, building, etc.).

Summary

Both worker and public safety are connected to the line extension issue. Maximizing worker and public safety is clearly a policy of the utilities.

Issue #2 - Reliability

According to the utility interviews, the need to maintain a highly reliable system is a major part of the operations and maintenance activities of the companies. Tree trimming, right-of-way maintenance and system monitoring all have been established. The movement of lines from off-road to on-road has been driven in part by a need to reduce outages and improve power quality.

The two most broad and utilized measures of service reliability are CAIDI (Customer Average Interruption Duration Index) and SAIFI (System Average Interruption Frequency Index). Both of these metrics are based and reported on a system-wide basis. The potential impacts of the line extension on aesthetic and land use, however, are more localized. The factors that directly affect reliability can also be lost in a system-wide metric. The local geography can define the types of interactions that can occur with the lines (animals, trees, and ladders) and the influence of weather, winds and snowfall. Measurement of reliability at the local scale (Town, census block, road) would be very helpful to better understand the influence of line extensions, system reliability and the geography of place.

2001 data for reliability clearly shows how the local geography relates to reliability. Utilities with large, rural territories such as VEC and WEC had higher averages for outage frequency and duration than utilities

with more mixed (urban and rural) franchises like BED, CVPS and GMP.

The utilities appear to spend a considerable amount of their effort and budget on maximizing their reliability. Obviously, no power is sold when the lines are down. A reliable electric system is a "public good"; the collective investment in the utility infrastructure provides a broad benefit that all can enjoy. The impact of maintaining consistent reliability in all contexts, however, introduces some problems. In some areas of the United States, the issue of "appropriate reliability" has been raised. In essence the issue is how much reliability do we expect in certain areas and should areas requiring higher levels pay a surcharge for that reliability[17].

Issue #3 – Capacity and Load

The utilities have indicated that they do not pre-build infrastructure in anticipation of development. Capacity, however, may be pre-built in some anticipation of growth. Because they do not pre-build infrastructure to any degree, new developments pay for least-cost improvements to achieve service needs.

Load growth is handled on a case-by-case basis. When an existing line warrants an upgrade from single-phase to three-phase or to increase voltage, the costs are borne mostly by the ratepayers. In light of the aesthetic issues associated with adding more line capacity (heavier wires, more transformers, etc.), the shift of costs from customer to ratepayer should be examined. While upgrades are not necessary extension of service, they are often associated with moving lines from off-road to on-road or adding pole height, etc.

One issue of capacity raised during the interview process was that the costs of migrating from low amperage rated lines to higher amps can be much more costly ("several times") for underground versus overhead. It seems that for most development this is not really an issue unless the request is for high usage industrial users.

Moving from lower amperage systems to higher amperage systems (particularly in underground settings) also requires expensive switchgear and ductwork as noted during the discussion of cost. While it seems that the utilities interviewed understand overhead distribution design well, the reality is that only BED has had extensive experience in underground main line extensions.

Issue #4– Line Losses & Efficiency

Electrical conductor is not completely efficient. The amount of loss (or inefficiency) on any line is proportional to the length of wire, all other factors held constant. More wire means less efficiency.

Distribution loss factors are often calculated on a network basis, not on a customer basis. Because of this any cost savings by improvement of efficiency (by reducing extension lengths, for example) would be diffused to all ratepayers.

Any policy that increases wire length beyond what is necessary to delivery power must consider the potential to increase line losses and reduce energy efficiency.

[17] Washington Utilities and Transportation Commission, Docket No. UE-991168-Electric System Reliability-Rule Making, 1999

Part III: Line Extension Policy Options

Section A: Introduction

How to best balance the need for a high-quality electric infrastructure with the needs to ensure protection of important resources of the State is a difficult one. Identifying line extension policy that helps achieve this balance is clearly in the interest of the State.

"There are at least four goals of regulation; control of monopoly, protection of consumers, substitution for competition and social allocation. This last goal, social allocation, seems to have two conflicting subgoals, namely, allocation for efficiency and allocation for ecological protection"[18]

Adoption of policy for regulated utilities obviously requires give and take. It can also be adversarial, but achieving this balance is critical to meet the needs of the diverse interests to these issues. Some policies may increase the costs to customers, taxpayers or ratepayers. Whether or not these costs are burdensome in light of the issues raised in this paper will be a critical and important point of discussion. Some may suggest that imposing limitations on extensions or increasing the costs of extensions (through adoption of policies) may be a growth control measure.

There appears to be three broad categories of policies that could be considered; *global* policies that would require specific extension prescriptions based on defined assumptions; *site specific* policies which address line extensions on a case-by-case basis and for specific contexts; and *procedural* policies which refine the permitting process or design elements for specific line extensions.

This part of the study will present policy statements for each type of option, define their positive and negative aspects, address major consideration for adoption, and describe the implementation process.

Section B: "Global" Line Extension Policy Options

The policy options presented in this section are broadly defined and of a global nature. They require specific extension forms based on a set of defined assumption and are universally applied.

***Global Option #1- No Change to Existing Policies*:** The existing policies and processes as described in Part I of this report should continue in their present state with no modification.

Positives

- The regulated utilities, Act 250 infrastructure, DPS, PSB, etc. all understand the current policies and have developed the technical and administrative means to work within the frame work.
- Maintaining the present situation will not require any costly process to achieving new policy.
- The present system allows considerable flexibility in design, no mandates as to extension form, has a public review process for most larger extensions and utilities

[18] Farris, Martin T., and Sampson, Roy J. *Public Utilities, Regulation, Management and Ownership*, Houghton Mifflin Company, Boston, 1973, p. 155.

are held accountable for failures in design by customers and the State.

Negatives

- The possible lack of aesthetic review for smaller projects under Act 250 would continue.
- The potential for enabling growth in areas outside of traditional town centers or growth areas and secondary environmental consequences of this growth are still possible.
- No global standards are in place for determining when to place utilities underground.
- The exact role of electrical service in enabling growth is unclear.
- Practices or policies that encourage roadside utility lines may conflict with aesthetic considerations.

Considerations:

Continuing under the current policy and regulatory regime would not require any additional expenditure of time or effort. The issues raised in Section II would continue, as would the public concern over them.

This option has no real implementation issues or strategy.

***Global Option #2- Require On-Road Line Extensions*:** It should be the policy of the State to require that new line extensions be placed along roads where feasible. Existing off-road lines needing upgrade will be required to move along-road. Both overhead and underground options can be considered.

Positives:

- The current practices for many of the regulated utilities appear to support the idea of moving on-road from off-road installations.
- On-road lines will have better access for maintenance and present a reduced safety hazard for line workers.
- Allows the consolidation of utilities reducing costs to ratepayers by eliminating redundant systems.
- The costs of on-road extensions may be lower due to less cost in securing easements, easier construction access, particularly for overhead.
- Maintenance for rights-of-way, including clearing and herbicide applications, will be reduced resulting in less maintenance costs and reduced environmental impacts.
- Reliability should improve as on-road lines will have less potential tree-line interference and be made serviceable more quickly.
- Requiring on-road installation would make extension of line subordinate to approval and permitting of roadway. This would increase the public involvement on the issue

Negatives:

- On-road lines (particularly above-ground) have a higher potential to negatively impact aesthetics. The visibility of the lines may be increased, as could the number of public viewers.
- The compatibility of line extensions with pedestrian environments and urban spaces may be an issue, particularly if overhead lines are considered.
- On-road extensions may improve the overall development climate of the area and increase pressure for growth. This is particularly true when the extension is adding new service area.
- A more linear settlement pattern can be enabled in part by a roadside line extension, due to the service drop and the costs of single-phase extensions. Other site-specific considerations must also be accounted for.
- Overhead line extensions placed along a road may limit access to property, reduce property values and limit ability to create roadside or "edge" development in appropriate districts. This is particularly true when the extension is a relocation from an off-road setting to an area already served by power.
- Vehicle collisions and public safety conflicts with line infrastructure could increase.
- Rural areas could see a disproportional impact from such a policy as it appears that the majority of off-road lines exist within rural areas.
- Serving remote settlements or communities could be more difficult if roadway access is limited.
- No standards are in place for determining when to place utilities underground.

Considerations:

In some ways this policy option is the current practice by many utilities, with benefits of roadside infrastructure falling mainly in operational, maintenance and systems management areas.

As described in Part II of this report, there can be significant impact to aesthetics when lines are moved roadside and overhead. It also opens up the opportunity for movement of other non-electric infrastructure to a roadside location. Movement from off-road to on-road settings can result in conflicts with the planned settlement pattern.

The movement of lines from off-road to on-road could also support a stronger development climate in areas where intensive growth may not be planned or wished.

One-size fits all options such as this tend to fall clearly in the face of scenic context and sensitivity to land development potential. Standards would need to be set that preclude certain areas from roadside locations. Standards would need to be

articulated to also when underground is required.

If, for example, the goal of protecting scenic resources is most critical, the standard could be- *the placement of utility line extensions above ground and roadside must be conditional to protection of scenic resources*. This makes the approval of a line extension subordinate to aesthetic and scenic issues.

Applying a standard such as this would require defining a process for when variations in design form are needed (off-road or underground when scenic issues preclude roadside overhead). For example, a standard might state- *if the roadside corridor is considered scenic by state, regional or local plans, then any utility line extension must be placed underground or other steps taken to minimize visual impacts.*

Another possible option would be to require the evaluation of the scenic quality of the area using the ANR Scenic Resource Evaluation Process. If the scenic context of the area does not meet some established level of quality, no mitigation or undergrounding is needed. If the scenic context does meet a level of quality, the utilities would have to assess the level of impact to the scenic resource from the project, whether the impacts are undue and adverse and whether or not mitigation will reasonably address the issue.

Policy options such as these would require approval of the PSB and cooperation with ANR.

***Global Option #3- Line extensions must take the shortest feasible route*:** It should be the policy of the State to require that all new line extensions including relocation or upgrades take the shortest possible route to provide service. Both overhead and underground options can be considered.

Positives:

- The capital construction costs could be lower if the shortest feasible route is taken.
- The shortest routes may reduce line losses and improve overall efficiency.
- Shorter routes may reduce potential to alter scenic contexts or change development climate.

Negatives:

- Many variables should be considered when selecting alignments. Feasibility must address engineering criteria and avoid known environmental constraints, sensitive landscapes, etc.
- The shortest path may conflict with scenic areas. Determining the balance between acceptable aesthetic impacts and shortest path may be difficult.
- As extensions are generally done in small increments, the shortest path in today's extension might be problematic for a subsequent connection. Where connections will be needed in the future is not always known in advance.

- Routes that bisect properties may impose obstructions to agricultural use or land development.

- Procurement of private easements may have a profound impact on the selection of shortest route. Least environmentally or aesthetically impacted route may not be available if right-of-way is not securable.

- Costs of securing rights-of-way may be high. Costs may increase as property owners become aware of value in being within of the shortest path. Additional consumer costs may result.

- Movement between on-road and off-road segments may make operations and maintenance more difficult by varying the level of access to particular segments.

- No standards for when to underground exist and would need to be defined. Aesthetic impacts can be largely addressed by undergrounding.

Considerations:

This policy would tend to create a rather chaotic pattern. Shortest path and least-cost may make sense for a specific project, but for a complex system like the distribution network that is built incrementally, over time, shortest paths might not be the same as time goes on. New infill and connections might create a web of lines that individually are the shortest path, but collectively are unorganized and inefficient.

For this very reason, the long-term impact of a policy like this could be worse for aesthetic and land use issues. Infrastructure that is scattered on-road then off-road might broaden the aesthetic impacts and increase the "surface area" for modifying the climate for growth.

Standards defining when to underground must also be created to successfully implement such a policy.

***Global Option #4- Existing routes should be used*:** It should be the policy of the State to require electric distribution line relocation or upgrades take place within the existing established corridor. New corridors should be established following review of operational, maintenance, engineering design, direct cost, visual impact and societal factors. Both overhead and underground options can be considered.
Positives:

- Aesthetics within existing corridors may be already impacted. Act 250 has given some deference to use of existing corridors as an aesthetic mitigation. Some town plans also encourage the reuse of existing corridors.

- Public concern for upgrades may be less than for extension into new routes.

- The development climate along existing corridors may not experience any additional growth pressure or "trigger" from upgrade or relocation.

- The need for new easements may be reduced provided engineering design could work with existing corridor.

Negatives:

- New upgrades or relocations along existing routes may eventually trigger scenic impact. Sensibilities of average person may have a threshold that additional lines, higher poles, more transformers, etc may exceed.

- Existing corridors may have become more aesthetically sensitivity as a result of land use modifications, evolving pedestrian scaled-environments, historic designation or by act of local or regional planning bodies.

- Local ordinances may preclude use of existing route or alter form of development (i.e. require undergrounding).

- Reuse of existing routes that have pre-existing operational or maintenance issues could prolong reliability or safety problems.

- Process for new extensions into un-served areas would have to be defined and standards created.

- Existing routes may no longer be efficient due to reforestation, road relocations or land use changes.

- Direct costs to ratepayers for reuse of corridors could be higher than for new corridor.

Considerations:

The reuse of existing corridors may have some real advantages. For many areas of the state, the ubiquitous nature of distribution lines means that some changes might not trigger a perception or a determination of aesthetic impact. In essence the visual "norm" is maintained. Similarly, potential growth impacts are triggered more broadly by new extensions into new areas. The development climate may be relatively unaffected.

Two major problems must be addressed:

1. What to do when the project will trigger a change to the scenic context of the existing area?
2. When land ordinances have been modified to preclude reuse of the corridor.

As to 1 above, the standard might be that if, through a Scenic Resource Evaluation Process /Queechee Analysis, the project as designed will fail and will be undue and adverse, then it must be placed underground.

For problem 2, the solution might require that existing corridors are protected by legislation from such actions unless some other compelling public concern is raised and that if reuse of the corridor is necessary that the project will be placed underground so as to minimize the potential aesthetic impacts.

The reuse of existing corridors may have operational issues, however. If the corridor has a pre-existing reliability, design or safety issue it may be more costly or impossible to continue to use the corridor. If it is more costly, the question of how much of the burden should the

customer requesting service bear arises. Similarly, a corridor may have evolved to be inappropriate for continued use.

***Global Option #5- Limit New Radial Extensions to Specific Distance from Main Lines*:** It should be the policy of the state to limit the distance of all new radial extensions (single-phase or 3-phase) serving residential or commercial uses to some maximum length. Non-residential uses that are deemed of critical economic or civic importance may be exempt from such limitations.

This policy option addresses one of the most fundamental issues observed during the study; the potential influence of long extensions to improve the development climate in areas outside of existing planned or developed centers.

The consultants have not suggested a maximum distance for this study. The issues (see considerations below) are complex, involving network design and engineering as well as in system reliability and safety issues. The actual trigger or limit may also be established on the basis of elevation (no extension above 1500 feet, for example) or in ridgeline districts, etc.

Positives:

- Limiting extension distances could reduce pressure for scattered development by altering the development climate to make remote settlements less desirable. This policy could also discourage hillside or ridgeline development patterns.
- Reduced extension distances could mean reduction in aesthetic impacts, greater environmental resource protection (less wildlife fragmentation, etc.)
- The goals of state and local planning policy are supported; growth centers and village centers are encouraged while rural development is discouraged. The orderly progression of growth is also supported by the braking effect of the distance limit.
- Slowing the extension process and concentrating service may improve system reliability and safety.
- Targets the request for service not the fulfillment of service.
- May align land use policy and goals with utility operational goals without placing burden on utilities to become land planners.

Negatives:

- Consumer choice may be limited or viability of property adversely affected. Some might argue that limiting extensions violate existing rules or represent a “taking”.
- Triggers for when to limit extension would need to be defined.
- Exemptions for extensions that promote overall system reliability or are required for additional network redundancy would need to be considered.

- Positive effects of limiting extensions might only be transient. Over time, incremental extension might create the same problems.

- The relationship between improved efficiency and reduction in O&M costs is not known.

Considerations:

A policy that limits the length of an extension might have a difficult time conforming to the "obligation to serve" aspects of current PSB rules. Although the rules clearly provide discretion as to when service can be extended, it might be a contentious issue.

Similarly, the actual trigger could be difficult to establish. The use of elevation 2500 feet is already considered to review a project. Various contexts might demand some flexibility in what triggers the exclusion. If the trigger is too liberal then vast areas of the state might be economically disenfranchised. If the trigger is too conservative then few projects will be excluded.

Establishing these guidelines and standards will require further examination of the issues and considerable collective negotiation between stakeholders.

Section C: "Site Specific" Line Extension Policy Options

While "global" options define the appropriate line extension form in a broad range of cases, "site specific" policies seek to determine the appropriate form by explicitly consideration of unique site or context factors including aesthetic, land use, environmental, operational and maintenance.

These options are only a few of the possibilities that could be explored. Others could be developed from continued discussion of these issues or adapted from global options to unique site specific settings.

***Site Specific Option #1- A Context-Sensitive Design (CSD) framework should determine line extension form*:** It should be the policy of the State to require that all new electric distribution line extensions, relocation or upgrades be evaluated against a context-sensitive series of goals to create an outcome that benefits the end user and public in general. Both overhead and underground options can be considered.

The movement towards a Context Sensitive Design (CSD) solution began with the adoption of ISTEA in 1991 but has been championed recently by the New York State Department of Transportation (NYDOT) was part of its roadway construction process. NYDOT recognized that transportation projects are integral to the community and provide real benefits. They also recognize that such projects can have substantial impacts on the community. The common thread through CSD is that each locale is unique and new infrastructure should recognize that individuality.

CSD looks to create an "end product that blends with its setting. Transportation needs are met, taking into account issues of safety and mobility. Community voices are heard, not just sought; they are seriously considered and their impact is apparent in final design. Optimally,

natural resources are enhanced or avoided as opposed to mitigated; playgrounds and parks are integrated rather than alienated; and visual, cultural and historic elements are highlighted rather than impacted. Context Sensitive Solutions are viewed as an asset by the users, and a success by the professionals and customers who helped to shape the final product."[19]

The notion of CSD is a philosophy that the NYDOT has extended into policy. Specifically, the following goals have been adopted that must be ascribed to for all transportation projects.

1. **The project is in harmony with the community and it preserves or improves the environmental, scenic, cultural, natural resources and economic viability of the area.**

2. **The project addresses both transportation and community needs as developed by a full range of stakeholders *e*.g. the Department, local governments, community groups, facility users, and other agencies.**

3. **The project incorporates early and effective Public Involvement.**

4. **The project identifies and addresses community issues through a continuous, structured format as appropriate for information exchange (Citizens' workshops, Advisory Committees, etc.), and active partnership with municipal or Federal/State/Local agencies.**

5. **The project incorporates innovative, safe solutions that add value for the user and the community.**

6. **The project is designed, built and maintained with minimal disruption to the community.[20]**

It may be possible to create a CSD framework to address utility line extensions. While there are differences between transportation and utility design, the primary function of both is to support the public's access to the world. Both are basically engineering projects and CSD has been recognized in the transportation-engineering world as a critical tool to ensure designs reflect community values and serve the public good.

Positives:

- Places the design process into a more public realm that may facilitate better communications and reduce potential conflicts at the time of construction or project initiation.

- Can enable a high degree of flexibility and creativity to the design process that addresses specific local issues and recognizes the unique qualities they have.

- Formalizes the public process uniquely to the line extension issue, enabling a greater public involvement and buy-in.

- Explicitly considers scenic, land use, cultural and other externalities throughout the design and approval process. The value of these factors can be measured in part through public involvement.

[19] NYDOT – Context Sensitive Solutions , Article for July 2001 Edition of New York Construction News by Tricia Millington.

[20] NYDOT Engineering Instruction Form E1-Context Sensitive Solutions, page 2.

- Is supportive of community and promotes long-term planning.

- Increases in project costs may actually reflect community values and be justified on that basis. Costs may actually be lower if equitable solutions are found that reduce extension lengths, improve system efficiency and reduce permitting, etc.

Negatives:

- More public involvement may mean more time and cost for design. Increases in long-term costs could be passed along to ratepayers. Procedures for participation and how the CSD process relates to permitting would have to be established.

- Might duplicate or overlap with existing review methods and procedures (Act 250, Queechee) that do address issues of context.

- Public involvement must be tailored to the unique circumstances of the project and community.

- It is not always successful.

- Creativity may create conflicts with existing design standardization. DOT's have had to address this issue and have faced problems in getting approval for radical solutions.

- Context-sensitive design may create economic inequalities or disproportionate expenditures within a franchise. One locale with less public involvement may get a less sensitive solution than another locale with a very vocal and involved public. Ratepayers would have to support this varying level of involvement.

- Decoupling electric distribution line extensions from other utilities (telecommunications, cable) may not address the potential aesthetic or land use impacts.

- A threshold for triggering a CSD process might need to be set. This process could impose a burden on utilities, ratepayers and customers for small projects.

Considerations:

The research and study of both aesthetic and land use issues points to one very important fact; sensitivity to place is essential. Vermont has made it a matter of policy through Act 200 to promote community and a sense of place. Scenic context coupled with land use context are major components of place. Any policy for line extensions that does not recognize and appreciate "place" can never fully address the quality of life issues that are at the root of aesthetic and land use impact.

Context Sensitive Design is an emerging policy. The eight tenets of the policy adopted by NYDOT might provide a framework for line extension policy. It also would redefine how projects are reviewed by placing greater emphasis on public involvement and less on review of designs after they have been created. The issue of what projects would need to be subject to the policy would need to be determined.

Implementation of a policy such as this would best be done through a settlement process rather than through rule making. It requires a commitment to action on the part of utilities that an adversarial process might not support.

Site Specific Option #2- Define a Policy to Require Undergrounding of Utilities: It should be the policy of the State to require that all new electric distribution line extensions, relocation or upgrades be placed underground when specific site criteria are considered.

A policy requiring new undergrounding has been the subject of much discussion in a number of states over the past several decades. At the forefront of this issue has been California, but other states such as Washington, Colorado and Hawaii have made movements in this area as well.

Rule 20 of the California Public Utilities Commission (CPUC) was established in 1967 and has been refined over the past several decades. This rule sets forth, in part, a process and criteria for determining when to bury existing electric distribution infrastructure. The three basic criteria that are used to determine when to underground are:

1. **Such undergrounding will avoid or eliminate unusually heavy concentrations of overhead lines;**

2. **The street, road or right-of-way is extensively used by the general public and carries a heavy volume of pedestrian or vehicular traffic; and**

3. **The street, road or right-of-way adjoins or passes through a civic area or public recreation area or an area of unusual scenic interest to the general public.**[21]

This policy clearly recognizes the importance of aesthetics and attempts to maximize the public benefits to the greatest number of individuals. It also provides recognition of the potential for impact from congested overhead lines as growth continues.

The CPUC program is voluntary for the county governments in that they must adopt local ordinances requiring underground within designated districts in order to take advantage of the program. The ordinance must also require that all upgrades to interior service connections be covered under the program (up to 100 feet) and that the overhead line must be discontinued.

Utilities are required to contribute 2% of gross revenues to a conversion fund. There is a specific time limit to the funds and any funds not committed under the above criteria are returned to the Utility. Annual reallocations are made based on how much communities are historically spending on undergrounding and in proportion with the size of the distribution network. Projects must also meet a minimum distance test of 600 feet or one block. Project contributions can range from 0% to 100%, depending on the specific criteria. At the discretion of the utility, additional projects can be considered if additional participation by the utility is warranted. Cited reasons may include the improvement of reliability, etc.

Hawaii has also addressed this issue of undergrounding electric infrastructure. Section 269-27.6(a) of the Hawaii Revised

[21] PG&E, Rule 20 – Replacement of Overhead with Underground Electric Facilities

Statues considered the following when requests for underground services are raised:

1. **Whether there is a benefit that outweighs the costs to place the electric system underground;**

2. **Whether there is a governmental public policy requiring the electric system be placed, constructed, erected, or built underground and the governmental agency establishing the policy contributes funds for the additional costs of undergrounding;**

3. **Whether any governmental agency or other parties are willing to pay for the additional costs of undergrounding; and**

4. **Any other relevant factors.**

Hawaii has not adopted provisions creating a utility fund from which governmental agencies can draw for such improvements. They do allow counties to create special improvement districts that assess the costs of undergrounding to property owners.[22]

The State of Maryland allows undergrounding districts to be created but has a utility liability limit of 50%[23]. Many states specifically exclude high-voltage transmission lines from these considerations.

The State of Washington has a clearly stated policy on undergrounding:

"It is hereby found and declared that the conversion of overhead electric and communication facilities to underground facilities and the initial underground installation of such facilities is substantially beneficial to the public safety and welfare, is in the public interest and is a public purpose, notwithstanding any incidental private benefit to any electric or communications utility affect by such conversion or installation"[24]

Clearly the intention in the above policy is that the costs externalities associated with above ground installation represent a great societal benefit outweighing the costs.

Positives:

- Many states have recognized the important aesthetic and land use benefits of undergrounding. These may provide a resource for creation of a new Vermont policy.

- Aligning specific line extension forms to specific aesthetic and land use contexts could improve the long-term planning abilities of counties and local governments. It may also provide the regulated utilities with a more consistent process for determining appropriate designs.

- Underground infrastructure may improve pedestrian environments, streetscapes, historic downtowns, etc. Aesthetic and quality of life benefits may go hand in hand.

- Long-term O&M costs could be lower because of increased reliability of underground systems.

- Increased public safety due as a result of removal of above ground lines; no downed lines and less vehicle accidents related to power poles. Utilities could have lower repairs and damage costs as a result.

[22] Section 44-77, Hawaii Revised Statutes
[23] Section 8.16, Article 66B, Annotated Code of Maryland
[24] Section 36.88.410, Revised Code of Washington.

- Reduced herbicide/pesticide application for right-of-way maintenance. This has a public health and cost benefit to utilities.
- Property values may increase as the result of underground service.
- New technologies may be created to reduce costs of undergrounding and promote efficiencies.

Negatives:

- Costs for undergrounding vary in part by the type (main line, tap line, single-phase). Cost recovery for new construction can often be made in market prices. Main line installations may have many stakeholders, or require the acquisition of easements, etc.
- Direct capital costs are typically higher, particularly for main line installations. "Hidden" costs also include removal of old lines and service connection modifications.
- Removal of existing overhead lines could require installation of new streetlights.
- Removal of only electric distribution infrastructure does not eliminate aesthetic impacts if telecommunications or cable facilities are still located overhead.
- Increased rates or taxes required to fund undergrounding could pose an undue burden on consumers in low-income communities.
- Increased costs for undergrounding could negatively impact economic development and business incentives.
- Lack of technological flexibility may reduce opportunities for future cost savings.
- One group may realize the benefits of the undergrounding but a larger group may share the costs.
- Pole-owning utilities may lose a source of revenue. Coordination with telecommunications and cable utilities in shared underground setting may be difficult to implement.

Considerations:

The discussion of when to underground utility lines is at the heart of many options presented. It is the only option that can significantly reduce aesthetic impacts. It also is the most expensive option, generally.

The debate and discussion of the issue around the United States appears to center on how to maximize the benefits of undergrounding relative to the higher costs. This approach has been addressed by PG&E by giving priority to areas of cultural or natural significance. This supports the ideas of scenic context. It also seeks to distribute the benefits to the greatest numbers by focusing on areas of vehicular and pedestrian movement (the viewer). No policies reviewed require universal undergrounding.

The other issue that is often discussed is how to pay for the differential costs of

undergrounding. Options include creating a fund contributed to by all ratepayers that is used to support undergrounding within the State, allowing or encouraging localities to levy taxes in support of undergrounding, or a statewide tax. Limits of exposure to utilities are also discussed (maximum of 50%, for example). The issue of economic equity and distribution of benefit is also raised when costs shift from those who directly benefit to a larger group. Do people in one portion of a franchise want to subsidize others?

Implementation of a policy for underground will require extensive process and cooperation between stakeholders. California, as well as others, has specifically included non-electrical utilities under the policy. Utilities will have to address specifically the cost differential and substantiate them; the State will need to develop the standards for when undergrounding should be considered. Policy would require action of the Public Service Board and perhaps the legislature.

Site Specific Option #3- Define a Policy for Impact Analysis of Line Extensions: It should be the policy of the State that prior to approval, all distribution line extensions be required to prepare an impact analysis that would consider a variety of factors, and would result in a basis for the decision on the appropriate design form.

Conceptually, such an option should incorporate a variety of site specific factors including aesthetic context, land use context, environmental sensitivity, operational, reliability, safety and maintenance factors. Cost could also be incorporated as a factor.

It should be noted that this option was added following final review by the Steering Committee.

Positives:

- Would define the appropriate line extension form on a case-by-case basis based on site specific factors.
- Could give considerable weight to site or context issues, depending on the nature of the analysis process.
- May help give local sentiment more status during review if public input is provided.
- May reduce permitting or streamline the process for determination of acceptable extension forms.

Negatives:

- The specific factors and analysis process would have to be determined. The applicability of some factors to specific situations might be questionable.
- Site specific factors might not adequately consider the incremental impacts of projects on larger areas.
- If operational, maintenance and cost factors are included; they may require conceptual design of the extension. Direct costs are highly site specific.

- Whether or not Act 250 review is continued would have to be determined. Could remove public input on the issue.

Considerations:

The development of an impact analysis methodology for distribution line extensions would require a clear definition of the factors that should be considered. The PSB and DPS would need to provide guidance to utilities on how to determine the appropriate factors on a case-by-case basis.

The unique characteristics of each site and its context will require consideration of both qualitative and quantitative variables. As discussed in other policy options, many of the externalities identified in this paper are often difficult to quantify, particularly if they are done so on a case-by-case basis.

Adopting a policy such as this would require rulemaking by the PSB.

Section D: "Procedural" Line Extension Policy Options

Unlike the "global" or "site specific" policies, these options represent possible changes to existing policies or processes to help reduce the potential for aesthetic and land use impacts. As noted previously, many existing rules and procedures do not appear to adequately address some of the issues raised under this docket. These "procedural" options are meant to address these inadequacies.

***Procedural Option #1- Define a Policy to Require Analysis of Alternative Energy Systems*:** It should be the policy of the State to require that all new residential line extensions outside of growth centers or within areas of low customer density be subject to a life cycle cost/benefit analysis of traditional service and alternative energy systems.

Previous discussion of this issue have centered on the use of distance as the trigger for requiring an analysis. The Hearing Officer recommended a distance of 1 mile[25] or about a $20,000 investment. The consultants suggest that, perhaps in addition to some distance or density trigger, due consideration of the land use context be made.

A 0.9 mile extension in a rural residential zoning district has the potential to improve the long-term development climate along the route. Conducting an analysis of alternative energy for these cases may help support a more rural and non-linear settlement pattern.

Additionally, the Net Present Value analysis of cost data provided by the utilities suggests that an extension of 1 mile for single-phase service could be nearly $60,000[26]. Any distance-based trigger should be set with recognition of the NPV costs over the life of the extension as well as potential hidden costs such as IRS gross-up and trenching.

The hypothetical case study was only 900 feet in length, yet the cost for an overhead connection was almost $10,000.

[25] VT Public Service Board Docket #5496, Technical Workshop and Scoping Session Report and Order, page 7.
[26] See Table 9. Single-Phase on-road service has a NPV cost of $11.36/foot.

The cost/benefit analysis should clearly show the requesting customer the upfront and long-term costs for both conventional electric service and alternative energy systems.

A policy such as this may have a braking effect on rural residential growth as the financing available for such developments has been historically difficult. A phone survey of larger lending institutions in Vermont suggested:

1. None of the institutions surveyed have policies *against* lending on this kind of development. The implication was that many are not active in support of financing.

2. All institutions would look at possibility on the merits of the individual case i.e. supporting comparable properties in region, individual credit, individual income, and capacity of alternative resource (wind, solar) to meet energy needs.

3. Chittenden Bank has a program called Socially Responsible Banking through which off grid development, utilizing alternative natural energy sources is viewed as socially responsible and thus given more leniencies in the evaluation of the individual project. The bank estimates it provides roughly $3M in financing on 10 to 20 such projects a year (residential).

If financing is not a consideration, the braking effect could be less obvious. A town, for example, might consider the results of such an analysis against town planning goals. Landowners, who do not choose the most cost-effective option, could face local permitting scrutiny.

Several other states have adopted policies addressing the cost-benefit of line extensions versus alternative energy systems. Some of these requirements are voluntary; others require positive findings in favor of the line extension over alternative systems.[27]

In general most policies are geared toward providing a fair analysis of the actual costs for an extension and giving the consumer an option.

Positives:

- This policy clearly promotes the use of alternative energy for residential properties. Such a policy is consistent with other State goals regarding use of alternative forms of energy.

- There may be positive aesthetic benefits by reducing extensions in rural areas. The amount of benefit would depend on the context of the project and how sensitive the landscape is to aesthetic impacts, development pressure and natural

[27] A ruling by the Colorado Public Utilities Commission requires utilities to provide a cost benefit analysis comparing the cost of line extension to remote customers and the cost of installation of a stand alone, on-site photovoltaic system. This analysis is required in cases where the ratio of monthly kWh consumption to distance in miles is less than or equal to 1,000. That is, if a customer lives a half mile (.5) from the nearest power line and they consume less than 500 kWh per month, then the utility is required to assess the relative costs of extending the power lines and installing a photovoltaic power system on-site.

resources that may be impacted by secondary growth.

- Adopting such a policy may help reduce the market attractiveness of large, remote lots in rural communities. Such lots are often associated with hillsides, ridgelines or other sensitive areas. The financing options for non-connected residential development are more limited than traditional options.

- By using a cost-benefit approach, the consumer may realize a savings in the long-term.

- May reduce utility costs by reducing maintenance of low-density (often rural) lines; may increase system reliability.

- May provide utilities with a new area of service beyond traditional distribution.

Negatives:

- The viability of alternative energy systems would have to be carefully considered. Backup power is generally needed and should be factored into the analysis.

- The ability to pay might affect those willing to participate in program. Upfront capital costs of an alternative energy system might be higher than for line extension.

- A voluntary program might not result in many successful implementations. The positive benefits to aesthetics and land use might not be realized.

- Determining the most appropriate trigger (line density, line usage, distance, land use context, etc) may be difficult given rural needs. Due consideration should be made for agricultural uses or support for affordable housing.

- Might place a burden on utilities or customers if the triggers are defined too broadly. Utilities may not be able to provide the required analysis. Other sources of support for the analysis would need to be identified and utilized.

- The components of the cost-benefit analysis would have to be defined and determined in a consistent manner.

- This procedure does not address extension of cable or telecommunications lines. Substantial impact from such services can result.

Considerations:

There are many considerations regarding adoption of this procedure.

1. *What should the trigger be?* The regulated utilities would need to carefully examine the pattern of extension relative to efficiency and establish some parameters for discussion. Adoption of triggers that reference consumption levels in addition to distance can be helpful to ensure that a rural use requiring grid access is not disadvantaged.

2. *What are the parameters for the cost-benefit analysis?* The Colorado form does not specifically address the positive aesthetic benefits when considering alternative energy. If such benefits are to be considered would they simply weight toward alternative energy? Clearly, what ever the parameters are, they must be adopted uniformly and consistently across the state for all cases.

3. *Who would provide the analysis?* In Colorado the utilities are required to provide the analysis. Should a more neutral third-party or an alternative-energy interested party prepare the cost-benefit? An inherent conflict of interest arises when one party is preparing the analysis. Utilities may not be "up to speed" on current trends in alternative energy systems.

The Colorado process was adopted as a rule by the Colorado Public Utilities Commission (CPUC). The rule making process of the Vermont Public Service Board would be the appropriate venue for adoption of a policy. Stakeholders will need to work through the process of identifying the triggers and analysis method.

Procedural Option #2- Refine the review under Act 250: The present Rule 2(A) of Act 250 limits the review of some smaller-scale line extension projects that could introduce aesthetic and land use impacts. The rule should be revised, through the direction of the Environmental Board and in cooperation with DPS and the regulated utilities, to require Act 250 review for projects of any type or size (overhead or underground) within conservation zoning districts, areas of noted scenic importance or historic significance.

Further, the rule should be revised to state that any line extension required for a development project must be reviewed under the same Act 250 application to ensure aesthetic and land use issues are considered within the same context. The line extension should also document why the chosen alignment was selected and discuss alternatives. If, for example, a cell tower needing an Act 250 permit happens to also need a line extension, one application covering the tower and the line extension, should be submitted and reviewed.

Positives:

- Protection of scenic and historic areas and supporting conservation zoning are clearly in the interest of the State.

- The Act 250 process is a major point in the line extension review process where aesthetic and land use considerations can be addressed. Broadening its scope may enable more public participation.

- Broadening the projects that qualify for review would serve to assure that a line extension projects does not result, either specifically or incrementally, in a degradation of scenic qualities.

- Utilities have established protocols for working within Act 250 and could accommodate new modifications.

- Could enable consideration of undergrounding in areas of conservation zoning.

Negatives:

- Creating more regulatory requirements for the utilities and State Government will result in more costs. These costs will be passed along to electric customers.

- The notion "historic significance" and "scenic importance" would have to be defined in terms of local context. Statewide recognition of these areas is articulated by Vermont Department of Historic Preservation, ANR and Act 250. Locally important areas may not rise to these statewide definitions, but could be considered in policy.

- District Commissions would have to address possible increases in caseload.

Considerations:

Changes in the triggers to Act 250 could be valuable to an overall policy. So long as Act 250 is where distribution line extensions are reviewed, and it appears to be the best suited to do so, broadening the range of project reviewed would help to gather public sentiment about the value of externalities. As a body of projects is completed a clearer picture on what the public values might emerge.

The most recent changes to Act 250 are still relatively new and have not been evaluated. It has been indicated that the number of projects under review is less. Following the successful process employed for the previous revision both DPS, utility and Environmental Board staff could work collaboratively in such a process. Legislative changes may be required.

Procedural Option #3- Development of a Statewide Line Extension Ombudsman: The State of Vermont should create a position within the Department of Public Service of Line Extension Ombudsman. This position would oversee all Department actions related to line extension policies and intervene in Act 250 or other permitting cases as a consumer advocate.

The utilities, working through the Department of Public Service should fund the office. The purpose of the position will be to establish dialog between the public and the utilities as it relates to proposed line extensions, provide review of land use, aesthetic and environmental considerations of Act 250 applications and in general provide guidance to the public on the extension of distribution line infrastructure.

Positives:

- The lack of public knowledge about the process (design, reliability, etc.) that goes into the extension of distribution lines is real. Providing access to a source of independent information would serve to facilitate better understanding of these issues and help reduce potentials for conflicts that might arise, particularly for aesthetic issues.

- A model of this program could be the Office of Health Care Ombudsman, recently enabled by the Vermont Legislature.
- It may promote least cost alternatives, factoring in societal issues.
- It may help ensure that those who are disadvantaged by virtue of access or economic potential are afforded access to the process.
- It may help consolidate diverse statewide responses to line extension projects into a single unified one.

Negatives:

- Any additional program would require upfront costs to support. Cost would be borne by rate payers.
- Would require individual(s) involved would have to have sufficient knowledge of both distribution systems planning and the externalities of the process to be effective.
- Making the position known to the general public would also require some effort and costs.
- May duplicate functions of the state already present.

Considerations:

This suggested program could be funded by the regulated utilities through a process developed under Docket 5496 or through passage of legislation. The position would most likely be based at the Vermont Department of Public Service.

Procedural Option #4- Development of a Common Statewide Design Standard: The State of Vermont should encourage and require the adoption of common design standards for electrical distribution extensions.

The utilities, working through the Department of Public Service should participate in the development of a common design standards and best design practices manual. The purpose of the document would be to show examples of good design techniques that respond to natural, land use and aesthetic factors.

This option was suggested following review of the draft report and has not been evaluated by all Steering Committee members.

Positives:

- It may help form the basis for addressing local or customer complaints and communicate the benefits of particular design forms.
- It may promote design alternatives which respond to aesthetic and land use issues.
- It may help reduce conflict over specific design forms and provide a rationale for the design selected.
- It may help streamline operational and maintenance protocols and make mutual aid more effective.

Negatives:

- Any additional program would require upfront costs to support. Cost could be borne by ratepayers.

- Cooperatives and others following different standards may need support to convert to common standard.

- Engineering and design flexibility would need to be addressed in standards. Unique site conditions may make prescriptive standards difficult.

- Non-electric utilities would need to provide input and participate in order to maximize effectiveness of standards. Aesthetic issues often involve collocation or joint-ownership projects.

Considerations:

The issue of common standards has been discussed previously under this docket. This process would have to be developed through the coordinated efforts of and in consensus between the regulated utilities and the DPS. Citizen input in the process of developing the standards would be helpful to assure that the approaches discussed address the heart of aesthetic issues.

Section E: Process for Creating Policy

The process for creating a policy or policies related to distribution line extensions will be complex. The issues raised in this paper show how divergent some of the issues can be and how there are clear positives and negatives for most possibilities.

Presently the process dealing with extensions falls into two camps- Act 250 reviews line extension requests at the time of application; the PSB reviews the rate and tariff structure based, in part, on past performance. A study in Hawaii noted a similar situation and suggested that it was "putting the cart before the horse."[28] Establishing policies that are pro-active may help increase public debate before significant time is spent on detailed design or permitting. The Context-Sensitive Design option clearly addresses this; others may as well.

Ground Rules:

The process towards developing a policy should consider and adopt some ground rules:

1. The value of benefits from one form of extension over others should be agreed upon. The aesthetic value of undergrounding over overhead lines for example.

2. The cost of determining the value of these "externalities", obtained through a contingent valuation or other econometric technique, should be shared by the utilities and directed through DPS.

3. The utilities should provide audited information on actual annual expenditures for line extensions including direct capital costs, form of extension, land context for extension (urban, rural), operations and maintenance costs.

4. The utilities and DPS should clearly state how reliability issues should be valued and determine a method for defining value.

5. Discuss and determine whether standards should be set or should evolve from broader policies or goals and through a public process.

6. The stakeholders should come to some agreement that the diffuse nature of line extensions will require input from a wide range of utilities. Smaller utilities must be given opportunities to participate and encouraged to do so.

7. The separation of electric distribution line infrastructure from telecommunications or cable should be eliminated. The issues are so interrelated and connected that action on one without the other could contradict the goals of any policy.

Process:

The rulemaking process of PSB may not be the best forum for movement forward on policy with regards to land use and aesthetic issues of line

[28] *Undergrounding Public Utility Lines*, Hawaii Public Utilities Commission, 2000, page 39

extensions. The study suggests that these issues are more contextual and demand a more collaborative approach.

Several options may be considered:

Independent Review: A third party, approved by all stakeholders, could serve as an independent reviewer of any policy. The independent review would submit comment on policy negotiated by the stakeholders and prepare detailed discussions of the issues they raise. The independent reviewer(s) could also work to fill any gaps in data or knowledge to more fully address policy requirements.

Settlement: It may be more advantageous for the stakeholders on this issue to develop a settlement process that focuses on reducing land use and aesthetic impacts from line extensions rather than on the procedural or legal issues of rulemaking.

The divergent issues of stakeholders in this docket are pronounced in some areas, notably in who bears the costs. Each party must clearly define the values for which compromise is not possible. A settlement process would require a broad participation, including telecommunication utilities, conservation organizations, consumer advocates, and representatives from local and regional governments.

A settlement approach to development of policy would appear to be well suited to the contextual sensitivity of the issues raised in this paper.

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