REPORT OF THE BROADBAND OVER POWER LINES TASK FORCE

The National Association of Regulatory Utility Commissioners

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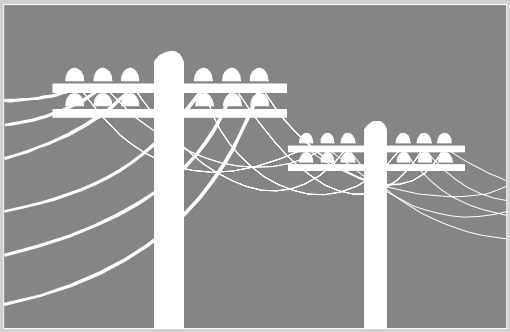

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EXECUTIVE SUMMARY

The Broadband over Power Lines (BPL) Task Force of the National Association of Regulatory Utility Commissioners was formed in December 2003 to explore the potential for deployment of Broadband over Power Lines and, in particular, the State commission role in advancing use of this technology.

BPL is a synergistic technology used to deliver high-speed data to end users over existing electric power networks and lines. It was the subject of an unprecedented joint statement by Chairmen of the Federal Communications Commission and the Federal Energy Regulatory Commission because the technology holds promise for extending service to underserved areas, facilitating broadband competition, and enhancing both security and reliability through a "smart grid." Throughout 2004, the Task Force met with industry experts and representatives of BPL broadband providers, electric utilities, and trade associations. This report is the first by the Task Force, which is comprised of commissioners involved in both the electricity and telecommunications sectors.

Early in its efforts, the Task Force saw the need to examine BPL issues within three broad areas: Technology, Security, and Regulatory. The Task Force spent considerable time learning about the basics of the technology. A basic understanding of the limits and potential of the technology is necessary as a backdrop for examination of the security and regulatory issues. On security, our review made clear that there is much to appreciate about BPL from both a homeland security standpoint, as well as the reliability potential inherent in the many "smart grid" opportunities presented by BPL for electric utilities. Finally, from a regulatory standpoint, we recognize that BPL deployment will likely encounter regulatory issues that are common to network industries, e.g., pole attachment rates, open access, cost allocation, affiliate transactions, and rights-of-way. Since BPL is an integrated component of the electric distribution network, the Task Force believes that it will be primarily up to the individual States to tailor appropriate regulatory roadmaps and responses.

The Task Force recommends that State commissioners take the time now to learn more about BPL technology. Policy makers will want to want monitor BPL to see whether and how it actually delivers on its many promises. States with BPL trials or small commercial deployments are encouraged to remain vigilant in their oversight of the offering and to share their observations with the Task Force.

Prescribing an anticipatory form of regulation could presume that we can know how technologies and markets will evolve. Regulators also want to avoid favoring any one technology over others and thereby distort the market or impede innovation. Absent any actual or imminent market failure or other threat to the public interest, however, oversight can be minimally intrusive. For BPL, the Task Force suggests a light-handed approach to regulation with a longer term focus on resolution of the regulatory issues cited above.

Over the coming year, the Task Force will remain engaged with industry stakeholders and customers, as we look to optimize the benefits of the technology for the public. The Task Force plans to continue to explore regulatory policy issues, as well as to spend more time in 2005 examining rural pilots. Specifically, we expect to:

(1) Continue to monitor the ongoing pilot programs and commercial deployments;

(2) Focus on emerging regulatory issues with an eye towards formulating a best practices guide for State regulators and providing updated surveys on State and industry activity;
(3) Scrutinize rural BPL deployments with a particular emphasis on any emerging technologies and circumstances that can facilitate rollout.

If you have surveys, white papers, studies, or technology overviews you believe may be of use to the Task Force in 2005, please send an e-mail to NARUC's General Counsel, Brad Ramsay, at jramsay@naruc.org.

I. INTRODUCTION

On December 16, 2003, the National Association of Regulatory Utility Commissioners (NARUC) announced the creation of a Task Force charged with exploring the potential for deployment of Broadband over Power Lines (BPL) and, in particular, the potential role of State public utility commissions in advancing the use of this technology. Then NARUC President, the Hon. Stan Wise of the Georgia Public Service Commission, stated that:

> (B)roadband over Power Lines may prove to be the third broadband pipe into residential consumers' homes, providing significant competition for cable modem and DSL service. I am pleased to announce that six extremely capable State regulators have agreed to join this effort. I am charging them with the task of seeing what States can do to complement the investigations of the FCC and the FERC in this area.[1]

Commissioner Wise appointed the following State regulators to the Task Force:

- Hon. Laura Chappelle, Michigan Public Service Commission, Task Force Chair and Vice Chair of the NARUC Committee on Electricity.
- Hon. Thomas J. Dunleavy, New York Public Service Commission, Co-Vice Chair of the NARUC Committee on Telecommunications.
- Hon. Julie Caruthers Parsley, Texas Public Utility Commission, Member of the NARUC Committee on Electricity.
- Hon. Tony Clark, President, North Dakota Public Service Commission, Co-Vice Chair of the NARUC Committee on Telecommunications.
- Hon. Denise A. Bode, Chairman, Oklahoma Corporation Commission, Member of the NARUC Committee on Telecommunications.
- Hon. Connie O. Hughes, New Jersey Board of Public Utilities, Member of the NARUC Committee on Telecommunications and Chair of the NARUC Ad Hoc Committee on Critical Infrastructure.

Additionally, the Hon. Robert B. Nelson of the Michigan Public Service Commission, who chairs the NARUC Committee on Telecommunications, participated as a source of valuable guidance in the meetings and deliberations of the Task Force.

In January 2005, NARUC President, the Hon. Marilyn Showalter, Chairwoman of the Washington Utilities and Transportation Commission, reconfirmed the Task Force membership.

Throughout its discussions, the Task Force benefited from the active participation and insights of staff from the Federal Energy Regulatory Commission (FERC), ably represented by David Tobenkin, and the Federal Communications Commission (FCC), through Rodger Woock. At the NARUC Summer Committee meetings on July 23, 2004, Task Force Chair, the Hon. Laura Chappelle, moderated a BPL panel discussion with participation by the Hon. Nora Mead Brownell of the FERC and the Hon. Kathleen Q. Abernathy of the FCC.

NARUC's Charles D. Gray, Executive Director; James Bradford Ramsay, General Counsel; and Brian Adkins, Legislative Director for Telecommunications, all provided valuable contributions. The Task Force wishes to thank the FERC, the FCC, and NARUC for the contributions of their

[1] Source: "NARUC Taskforce on Broadband over Power Lines" (January 29, 2005) URL: http://www.naruc.org/displaycommon.cfm?an=1&subarticlenbr=334.

respective representatives. Staff participants from a number of State commissions, especially Don Jones (Texas), Steve Wilt (Oklahoma), Illona Jeffcoat-Sacco (North Dakota), Jeffrey Pillon (Michigan), and Ken Roth (Michigan) also provided substantial input. Additional technical review and editing of the report was provided by Dr. Janice Beecher, Director of the Institute of Public Utilities at Michigan State University. The Task Force could not have had such a busy, productive, and insightful year, were it not for the hard work and insights of all these individuals as well as the efforts of many that we were unable to separately list here.

II. OVERVIEW

The year 2004 was important for BPL, the technology used to deliver high-speed data over existing electric power networks. BPL allows electric customers to obtain broadband service and, with it, access to the limitless content of the Internet. In rural areas, BPL could provide access to broadband service, either as an initial sole service or a competitive option, in otherwise expensive-to-serve markets. In more densely populated markets that already have broadband options via digital subscriber line (DSL) or cable -modem, BPL could provide that sometime elusive "third pipe" or "third wire" facilities-based option needed to facilitate vigorous competition.

Equally important are the potential "smart grid" capabilities of BPL. As discussed in Part III, BPL might allow electric utilities to significantly improve their ability to monitor and control lines and facilities. The integration of BPL technology with electrical operations may position a utility to achieve more network automation. While operational enhancements have always been of interest to the electric industry, the August 14, 2003 Northeast power blackout and its aftermath broadened interest in the preventative measures that might be achievable though BPL.

In the wake of the blackout, and the inception of several BPL pilot programs, the technology became the subject of numerous articles, industry white papers, and federal policy initiatives. This uptick in interest emerged just as the Task Force began investigating the technology.

On October 14, 2004, the FCC and the FERC joined to focus national attention on BPL. The FCC voted to approve standards relating to radio frequency interference to reduce concerns that interference problems would impede BPL's development.[2] The same day, the FERC and FCC chairmen issued a joint statement that commits their respective agencies to foster policies to encourage rapid deployment of BPL. According to Chairmen Powell and Wood, whatever the underlying technology, broadband is essential to the national well-being. They agreed that ". . . [p]olicy-makers at all levels should coordinate their efforts to promote a minimally intrusive policy framework for such technologies." The statement identifies BPL as one emerging technology that could increase competitive broadband choices. It acknowledges that BPL may also improve electric utilities' communications and control capabilities and thereby enhance their reliability and efficiency. The joint statement concludes with the following areas of agreement:

- Utilities should "pursue new . . . technologies, such as BPL, that will foster greater customer options in broadband, provide more efficient management of the power supply system, and ensure increased operational reliability."
- Utilities should "appropriately allocate revenues and costs related to new technologies, such as Access BPL, between regulated and unregulated functions."

[2] *Carrier Current Systems, including Broadband over Power Line Systems*, ET Docket No. 03-104; *Amendment of Part 15 regarding new requirements and measurement guidelines for Access Broadband over Power Line Systems*, ET Docket No. 04-37, noticed at 70 Fed. Reg. 1360. The FCC issued the text of the rules October 28, 2004.

- Development of new competitive broadband technologies should be encouraged.
- The FCC and FERC should "monitor experience with Access BPL to ensure that existing regulations do not stifle [its] development."

Over the last year, the Task Force has held numerous phone conferences with industry experts, as well as representatives of BPL broadband providers, electric utilities, and trade associations. On October 24, 2004, the Task Force convened for a day-long session in Arlington, Virginia, to interact with several leading commentators on BPL-related developments. Several members of the Task Force also benefited from a hands-on demonstration of BPL home applications provided by Current Communications Group, LLC (Current) at a residence it maintains for that purpose in Potomac, Maryland.

During these meetings and calls, the Task Force heard from many diverse sectors of the BPL community, such as enthusiast trade groups (the United PowerLine Council, the Power Line Communications Association), individual BPL providers (Current, Amperion, Inc.), investor-owned electric companies (Consumers Energy Company, Cinergy Corp), a municipal utility (the City of Manassas, Virginia), a rural electric cooperative (Central Virginia Electric Cooperative), industry trade groups (National Energy Marketers Association, Edison Electric Institute), a cable company (Cox Communications, Inc.), and preeminent consultants and industry observers.[3] The Task Force also heard some cautionary input regarding radio frequency interference, most notably from the American Radio Relay League (ARRL). Although of general interest, the Task Force deferred to the FCC on this issue, due to a pending rulemaking by the commission, which resulted in the promulgation of final rules in October 2004.[4]

Early in its efforts, the Task Force saw the need to examine BPL issues within three broad areas: Technology, Security, and Regulatory. The Task Force divided itself into three working subgroups to concentrate on these major areas of interest as follows:

Technology: Commissioner Bode and Commissioner Parsley
Security: Commissioner Chappelle and Commissioner Hughes
Regulatory: Commissioner Clark and Commissioner Dunleavy

As a foundation for the Task Force's examination of security and regulatory issues, the members spent considerable time learning about the technology and different modes for deployment. Site visits and related demonstrations and discussions provide policy makers an invaluable backdrop on the possibilities and potential issues raised by this synergistic technology. The Task Force strongly encourages commissioners and other policy makers to view BPL pilots where available.

The investigation of security related issues was particularly interesting. As discussed in more detail below, BPL raises many intriguing possibilities from both a homeland security standpoint, as well as the many "smart grid" options for electric utilities.

From a regulatory standpoint, BPL deployment will eventually require resolution of several issues common to network industries. Pole attachments, open access, cost allocation, affiliate transactions, and rights-of-way and other issues will require resolution. How these issues are resolved will impact how BPL is ultimately provided. Since BPL is an integrated component of the electric distribution network, the Task Force believes that it will be primarily up to individual states to tailor appropriate regulatory roadmaps and responses.

[3] Appendix A provides a summary of the Task Force's Arlington meeting and numerous teleconference calls.
[4] *See supra* note 2. A more detailed discussion appears in Part III of this paper.

The Task Force's examination to date suggests BPL potentially offers multifaceted benefits ranging from enhancing the security and reliability of electric service to enhancing competition in the broadband space. Task Force members agree generally with the FERC/FCC Joint statement that the development of new competitive broadband technologies should be encouraged and that a minimally intrusive approach to resolution of the issues surrounding BPL service is possible. The long term resolution of the various outstanding issues should not favor any technology over another. If BPL can play a role in expanding efficient broadband access, the public interest will be served.

III. TECHNOLOGY

Currently, broadband Internet access is offered to residential and small-business customers through DSL, cable-modem, wireless, optical fiber, and satellite technologies. Broadband over Power Lines, or BPL, is another mode of broadband access. BPL deployment remains in the developmental stage in most locales where it is available.

How BPL Works

BPL, also known as power-line communication, utilizes electric power distribution wires for the high-speed transmission of data by transmitting high-frequency data signals through the same power distribution network used for carrying electric power to household users. In a common form of BPL, the broadband connection is provided over the electrical wires that enter a house; a customer can obtain Internet access by plugging a BPL modem into any residential electric outlet served by the BPL system. In another form of BPL, Internet access is provided using a wireless device (such as a WiFi access point) connected to a BPL distribution system outside of the home that communicates with the customer's computer or other equipment inside the home.

The low-power, unlicensed equipment that is being employed in modern BPL systems couples radio frequency signals onto the existing electric power distribution lines for distribution throughout a neighborhood. A BPL system requires a means of getting the data signal from an Internet service provider (ISP) to a location where the broadband signal is injected into a power line. The data signal can be provided to the injection point over conventional copper, fiber, or wireless facilities. The principal benefits of BPL are that no new wires need to be installed in order to distribute the broadband connection to each house in a neighborhood, and BPL can be accessed anywhere in each house without additional inside wiring.

It is important to note that BPL technology, in its current form, is not suitable for carrying broadband signals over long distances. The broadband communication channel must be brought into a neighborhood by other means, and then BPL can be used as the distribution mechanism to reach individual homes or businesses.

Strategic advantages attributed to BPL include relatively easy installation, low cost of entry, and quick deployment. BPL allows power lines to carry signals for moderate distances without regeneration, requires no changes to be made in business or household wiring for broadband access, provides broadband access from every electric outlet in every room, poses a relatively low entry barrier for electric utilities wanting to offer broadband service, and utilizes a pre-existing infrastructure—the electric power grid.
BPL equipment manufacturers and service providers anticipate a wide range of applications that may be offered to subscribers. High quality, multi-channel video, audio, voice-over-internet protocol

(VoIP), and on-line gaming applications are expected to rapidly increase the demand for additional bandwidth. To support the typical subscriber at 1 megabit per second (Mbps), BPL systems are expected in the near future to operate at speeds of 100 Mbps or more on the medium voltage (MV) power lines. Most of the presentations made to the Task Force indicate that the BPL industry is gearing up for growth. The level of activity and interest, as evidenced by NARUC's state-by-state survey results (attached as Appendix B), is clearly on the rise.

In addition to providing broadband connectivity to customers in an electric -service area, BPL systems may be used by electric utilities to manage their electric power networks more efficiently. Possible electric utility uses for BPL include automatic meter reading, voltage control, supervisory control and data acquisition (SCADA), equipment monitoring, energy management, remote connect and disconnect, power outage notification, and the ability to collect detailed power usage information (such as time-of-day power demand).

BPL is a "*carrier-current*" system that operates in the United States on an unlicensed basis under Part 15 of the FCC's rules, 47 C.F.R. § 15.1 *et seq.* (2004), which allows certain low-power unlicensed equipment to operate on a non-interference basis. *Carrier-current* is a term used to describe systems that intentionally conduct signals over electrical wiring or power lines. Prior *carrier-current* systems have been used for many years to conduct *low-speed* data over power lines. Because of the inherent impedance and attenuation variations of power lines, as well as noise from dimmer switches, motorized electrical appliances, computers switching on and off, and other devices, reliable *high-speed* communication over power lines has been difficult to achieve. However, the recent availability of faster digital processing technologies and the development of sophisticated modulation schemes have produced new designs that overcome these technical obstacles. These new designs have led to the development of new BPL systems that use spread-spectrum or multiple-carrier techniques and that incorporate adaptive algorithms to overcome the problems associated with noise in the power lines.

This report considers primarily what the FCC refers to as "Access BPL." In Access BPL, electric power lines are used to provide Internet connectivity into a home from an outside source. Access BPL employs outdoor devices that inject data signals into the medium- and low-voltage power distribution network to provide Internet access to a neighborhood. Since BPL signals cannot usually pass through an electric distribution transformer, additional equipment usually is required to allow the data signal to bypass distribution transformers, or to regenerate the data, in order to get the data signal into customers' homes.

In contrast to Access BPL, so-called "in-house BPL" utilizes indoor adapters to transmit data signals over existing interior electric wires within a home, and to connect the data signals to various appliances. In-house BPL systems use the electrical outlets available within a building to transfer information between computers and other home electronic devices and appliances, eliminating the need to install additional wires among devices.

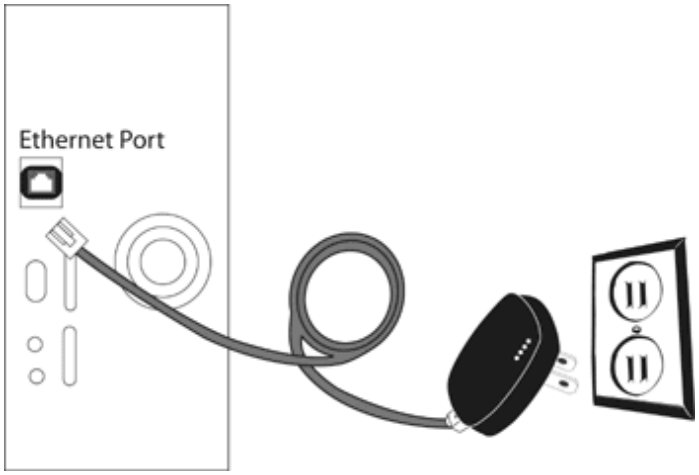

Exhibit 1. Plug-in Ethernet BPL Modem[5]

In a typical Access BPL system, the equipment required to provide service includes (1) injectors, (2) repeaters, and (3) extractors. BPL injectors are connected to the Internet via conventional technologies (e.g., fiber, copper, or wireless) and couple the broadband signal to MV (1,000-40,000 volts) power lines bringing power from an electrical substation to a residential neighborhood. MV power lines may be located overhead on utility poles or underground in buried conduit. BPL systems can be employed in either case. BPL systems are not presently deployed on high-voltage electric transmission lines.

BPL signals are conditioned and conveyed between the MV power distribution lines and the households within the service area by "extractors" that move broadband data in both directions. An extractor typically is located at each low voltage (LV) distribution transformer providing power to a group of homes. Some extractors boost BPL signal strength sufficiently to allow transmission through the LV transformer; others relay the BPL signal around the transformer via couplers on the adjoining MV and LV power lines. Other kinds of extractors interface with non-BPL broadband devices (e.g., WiFi transceivers) that extend the BPL network to the customers' premises.

A typical BPL signal will only propagate along a power line for 1,000 to 3,000 feet before it becomes too weak or distorted to be useful. To span longer distances between injectors and extractors, repeaters can be used to regenerate and amplify the signal and achieved the required strength and fidelity. It should be noted that some BPL providers choose not to employ repeaters, as they decrease overall available bandwidth, require the use of additional frequency spectrum, and introduce some latency (delay) in the data signal.

The following figure illustrates a basic BPL system, which can be deployed in cell-like fashion over a large area served by existing MV power lines by installing multiple injectors, repeaters, and extractors.

[5] Current Communications website at: http://www.current.net/LearnMore/HowItWorks/. Used with permission.

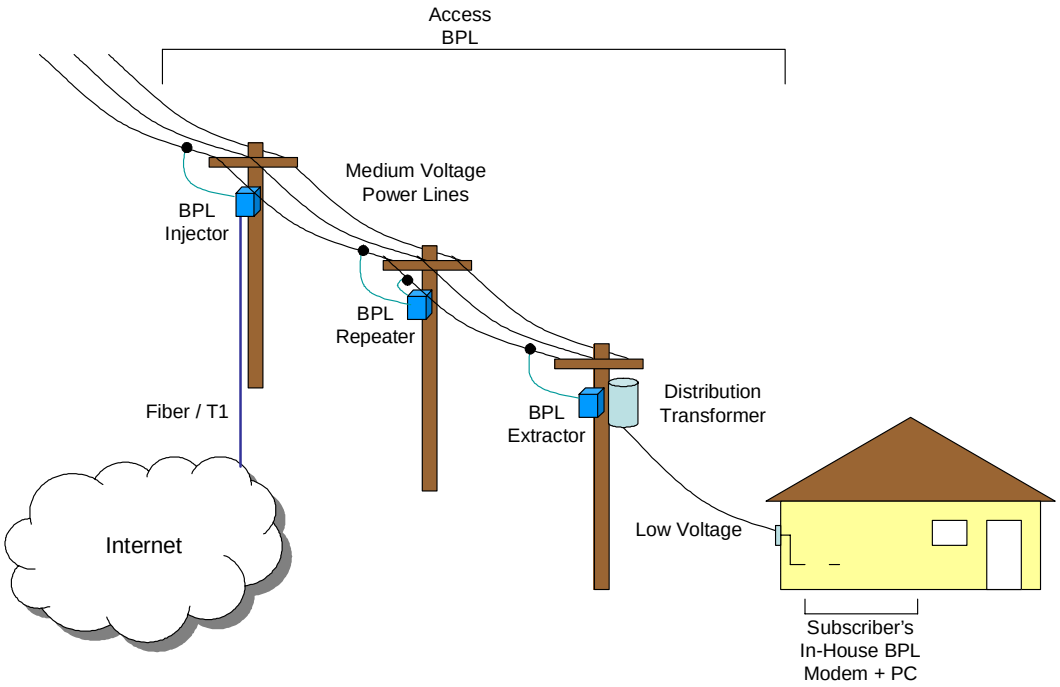

Exhibit 2. Basic BPL System[6]

Network Architecture

A number of different network architectures are used by BPL providers. In a report issued to address radio interference, the National Telecommunications and Information Administration (NTIA)[7] identified three principal network architectures used by BPL equipment vendors, as described here.

One system uses Orthogonal Frequency Division Multiplexing (OFDM) to distribute the BPL signal over a wide bandwidth using many narrow-band sub-carriers. At the BPL injector, data from the Internet backbone is converted into the OFDM signal format and then coupled onto one phase of the MV power line. An injector also converts BPL signals in the other direction from the MV power lines to the format used at the Internet backbone connection. The two-way data flow is transferred to and from the LV lines, each feeding a cluster of homes, using BPL extractors to bypass the LV distribution transformers. The extractor routes data and converts between access and in-house BPL signal formats.

The subscribers access this BPL signal using standard in-house BPL devices.

To span long distances between a BPL injector and the extractors it serves, repeaters may be employed. In this arrangement, the injector and extractors share a common frequency band (F1) on the MV power lines, different than the frequency band (F2) used on the LV lines by the subscriber's in-house BPL devices. In order to minimize contention for the broadband channel, Carrier Sense Multiple Access (CSMA) is used with Collision Avoidance (CA) extensions. This type of system is

[6] "Potential Interference from Broadband Over Power Line Systems to Federal Government Radiocommunications at 1.7 – 80 MHz, Phase 1 Study," NTIA Report 04-413, April 2004, at p. 2-2.
[7] *Id.*

designed to accept some amount of co-channel interference between quasi-independent BPL cells without the use of isolation filters on the power lines, as all devices on the MV lines operate over the same frequency band. BPL signals are coupled into one phase line. The BPL signal may be sufficiently tolerant of co-channel BPL interference to enable implementation of two or three independent systems on adjacent MV power lines.

A second BPL network architecture also uses OFDM as its modulation scheme, but differs from the first system in the way it delivers the BPL signal to the subscribers' homes. Instead of using a device that connects to the LV power lines, this second architecture extracts the BPL signal from the MV power line and converts it into an IEEE 802.11b WiFi signal for a wireless interface to subscribers' WiFi enabled appliances as well as to local portable computers having WiFi adapters. Technologies other than WiFi may also be used to interface to subscribers' devices with the BPL network. This wireless architecture that bypasses the house LV wiring is used by Amperion, Inc. An example of Amperion's equipment is shown below.

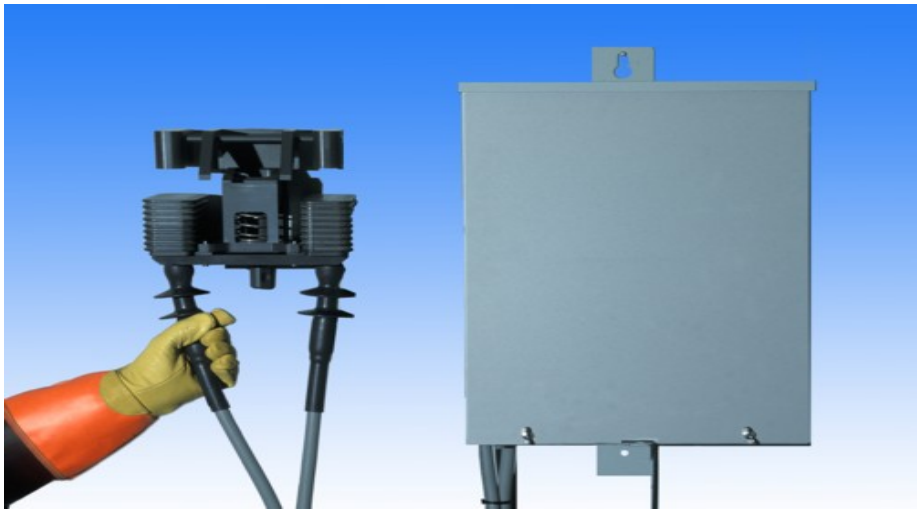

Exhibit 3. Amperion Power Line Coupler and Weatherproof Enclosure[8]

This second architecture uses different radio frequency bands to separate upstream (from the user) and downstream (to the user) BPL signals, and to minimize co-channel interference with other nearby Access BPL devices. To span long distances between a BPL injector and the extractors it serves, repeaters may be employed. Like the injectors, the BPL repeaters transmit and receive on different frequencies, and they use different frequencies from those used by the injector and other nearby repeaters. A repeater may also provide the capabilities of an extractor when outfitted with a WiFi transceiver. Like the first architecture described above, this approach couples BPL signals onto one phase of the MV power line.

Finally, a third type of BPL network architecture uses Direct Sequence Spread Spectrum technology to transmit the BPL data over the MV power lines. All users within a BPL cell share a common frequency band. In order to minimize contention for the channel, CSMA technology is used. As in the first architecture described, this type of system is designed to accept some amount of co-channel interference between cells, as all devices operate over the same frequency band. At one deployment

[8] Amperion website, at www.amperion.com/products.asp. Used with permission.

site using this third type of architecture, the BPL service provider independently implements two channels on the same run of three-phase power lines.

Each cell in this third embodiment includes a concentrator (injector) that provides an interface to a T1 or fiber link to the Internet backbone, a number of repeaters (extractors) to make up for signal losses in the electric power line and through the distribution transformers feeding clusters of dwellings, and customer premises BPL equipment, which is used to bridge between the user's computer or other appliance and the electrical wiring carrying the BPL signal. Adjacent cells typically overlap, and the customers' BPL terminals and repeaters are able to communicate with the concentrator that affords the best communication path at any time. An injector in this type of system couples the BPL signal onto the power line using a pair of couplers, one on one of the phase lines and the other on the neutral line. This architecture has been employed by Main.net.

Another experimental BPL architecture utilizes the 2.4 gigahertz (GHz) and 5.8 GHz unlicensed bands. An implementation using multiple IEEE 802.11b/g Wi-Fi chips sets has been used to demonstrate the concept of carrying data over MV power lines at rates exceeding 200 Mbps. However, no party filed comments in the FCC's BPL proceeding contending that this technology and associated frequencies should be considered in the Part 15 BPL proceedings.

Radio Interference

In accordance with Part 15 of FCC regulations, 47 C.F.R. pt. 15, BPL must operate on a noninterference basis relative to licensed services. It must accept interference from licensed services and not cause harmful interference to them. Examples of licensed services below 30 megahertz (MHz) are AM broadcasters, amateur radio operations, aeronautical services, maritime operations, and land mobile services. Users of this spectrum also include, for example, public safety and federal government agencies.

Most Access BPL systems today operate on frequencies up to 80 MHz with very low power signals spread over a broad range of frequencies. BPL must comply with federal radiated emission limits for CCS (below 30 MHz) and Class A/B digital devices (above 30 MHz).

One of the main issues requiring attention in connection with BPL deployment is actual and potential radio interference. BPL systems use frequencies that radiate into the air from the open wire power conductors, causing possible interference to licensed services, including emergency services and amateur radio operators. Unlike other broadband conductors, open-air power lines are excellent radiators of the frequencies used in BPL systems, so they behave as transmitting (and receiving) antennas. This issue has not arisen in connection with other broadband distribution technologies because copper twisted-pair wiring (used for xDSL), coaxial cable, and fiber are all effectively non-radiating mediums.

The radio frequencies used in BPL systems generally lie in a range between 1 and 80 MHz. This part of the radio spectrum has unique properties that do not occur at other frequencies. Of particular importance is the fact that radio waves at these frequencies can "bounce" off the ionosphere to travel very long distances. Certain frequency bands in the high-frequency range are used by amateur radio operators to communicate around the world using very low transmitted power levels. Harmful interference can occur if a BPL system operates in the vicinity of a licensed operator using the same frequency. However, BPL providers addressing interference issues claim that the technology now exists to "notch-out" (refrain from using) frequency bands that are used by proximate amateur radio operators. They also suggest that improved modulation schemes may help address issues regarding signal-to-noise ratio at very low power levels required to avoid interference. Data-encoding methods

may be employed to prevent electronic eavesdropping, in order to provide confidential and secure communications using a BPL system. However, groups that have an interest in maintaining authorized uses of the radio airwaves (such as ham and shortwave radio operators and emergency governmental frequency users) have been adamant that BPL causes radio interference and will create widespread problems if it is widely deployed. Some radio amateurs and broadcasters contend that, in addition to causing interference near the power lines on the particular frequencies used, BPL will be a ubiquitous polluter of the radio spectrum, causing a substantial rise in background radio-frequency noise levels—something akin to "radio smog." The ARRL has demonstrated both the interference effects of BPL on amateur radio communications and the strong interference from very low-power high-frequency transmitters into a BPL network, using BPL test sites operating in the United States. These concerns merit consideration, if only because much of the emergency response system in place today relies on these radio frequencies.

Radio broadcasters have also expressed concern about the potential of BPL to prevent their signals from reaching listeners. The Research and Development branch of the British Broadcasting Corporation (BBC) released a report on a brief BPL trial in Scotland. The two competing BPL systems in operation in the town of Crieff both interfered with high frequency broadcast reception. Tests were conducted at four locations. At the first location, a residence, interference from a Main.net modem was audible even on very strong broadcast signals. Reception was also significantly impaired at a neighbor's house, as well as at various locations in the street between the residence and the substation serving it. This was despite the fact that the main electrical distribution cable was underground.

In the United States, the FCC has been the primary forum for resolving radio interference claims. Throughout most of 2004, the FCC conducted a rulemaking to consider BPL-specific changes to its Part 15 rules that govern radio frequency interference.[9] Instrumental to the FCC's deliberations was the exhaustive

Phase 1 study on radio interference conducted by the NTIA, which resulted in an April 2004 report with recommendations.[10]

As referenced earlier, the FCC concluded its Part 15 rulemaking in October 2004 and made several significant changes in its rules applicable to BPL. For example, the FCC rules:

- Clarify that the existing Part 15 radio frequency emissions standards apply to BPL;
- Impose operational requirements for BPL systems to promote avoidance and resolution of harmful interference, including technical mitigation capabilities like "notching;"
- Prohibit BPL in specified frequencies and geographical areas designated for licensed uses for aeronautical and maritime functions;
- Create consultation requirements with public entities related to public safety;
- Establish a publicly accessible database of Access BPL systems as a means of public notification;
- Impose FCC certification requirements on Access BPL equipment; and
- Introduce improved measurement procedures and guidelines to test BPL equipment for radio interference.[11]

[9] See *supra* note 2.
[10] See *supra* note 6.
[11] This synopsis of the FCC's technical rules is based in part on the October 24, 2004 presentation of the FCC's Bruce Franca to the Task Force, as well as the FCC's October 14, 2004 press release.

To implement interference mitigation solutions while simultaneously maximizing the usable bandwidth of the broadband channel provided, BPL systems are expected to use new modulation techniques that can support more sub-carriers that are more finely spaced. As data rates and bandwidth requirements grow, the BPL systems may operate at greater overall transmitted power levels but not necessarily with higher power density than is used today. BPL vendors may employ techniques to dynamically adjust the power level to maintain a minimum signal-to-noise ratio over the entire BPL spectrum, while limiting emissions to levels compliant with Part 15. One vendor has proposed such a solution for adjusting transmitted power to maintain a constant signal-to-noise ratio across the BPL spectrum, with a hard limit based on Part 15 rules. The challenge will be to develop a control mechanism that can optimize the broadband signal while simultaneously limiting the radiated emissions, perhaps in conjunction with frequency agility and adaptive filtering.

Nortel has developed and patented a filter that blocks BPL signals while concurrently passing medium-voltage AC power. The judicious use of such blocking filters could enable segmentation of BPL networks into adjacent cells of various sizes having low conducted interference from neighboring cells. This technology could give a BPL operator more flexibility to mitigate local interference and enable a greater level of frequency reuse in BPL systems than what is currently possible.

Aside from the technical findings reflected in the Part 15 rule revisions, the FCC's decision to address these issues head-on is itself significant. *The rules should foster BPL's acceptance as a mass-market technology by conferring a measure of assurance that radio interference issues will not frustrate its progress*. The FCC expressed confidence that its new Part 15 would be adequate for this purpose:

> It is our intention to ensure that Access BPL operations do not become a source of harmful interference to licensed radio services. Based on extensive research, analyses, and practical experience, we also continue to believe that the interference concerns of licensed radio users can be adequately addressed and that Access BPL systems will be able to operate successfully on an unlicensed, non-harmful interference basis under the Part 15 model. In this regard . . . we find that the harmful interference potential from Access BPL systems operating in compliance with the existing Part 15 emission limits for carrier current systems is low in connection with the additional rules we are adopting. From the information provided by our field tests, the tests conducted by NTIA, theoretical predictions by NTIA and ARRL, and experience of the several tests of Access BPL systems, we observe that the potential for any harmful interference is limited to areas within a short distance of the power lines used by this technology. As emphasized by NTIA's Phase I study and comments, interference can be rapidly eliminated through various means should it occur. . . . . [T]he broadband service capabilities of Access BPL systems offer important opportunities for establishing a new medium for broadband access and for introducing new competition in the broadband market. We believe that it is important to set forth rules that will promote this service now, rather than delay. . . . . While some cases of harmful interference may be possible from Access BPL emissions at levels up to the Part 15 limits, we agree with NTIA that the benefits of Access BPL service warrant acceptance of a small and manageable degree of interference risk.[12]

[12] FCC Report and Order at 23.

It is likely that interference concerns will continue to be debated. Commissioner Copps noted his concerns regarding radio interference. Although Commissioner Copps approved the technical rule changes, he dissented in part to the FCC's decision.[13]

At the Task Force meeting on October 24, 2004, Paul Rinaldo, ARRL's Chief Technology Officer, cogently summarized ARRL's views on interference. He cautioned that avoiding radio frequency interference is not a matter of core competence for the electric utility industry.

NARUC and the Task Force recognize the FCC's jurisdiction over radio emissions and its role as arbiter of these issues. The Task Force is optimistic, however, that the FCC's solution will sufficiently resolve the interference issues so that BPL can deliver on its promise of delivering universal, economical broadband service and improvements to electricity delivery systems.

Technical Constraints on Rural Service

Because electric distribution lines exist in most rural areas, many have hoped that BPL would help solve the problem of how to extend economical broadband services to underserved areas that are too sparsely populated to have broadband access through cable television lines or DSL. However, most observers close to the BPL industry are not optimistic with regard to this potential.

As noted earlier in this discussion, BPL configurations use electric lines to provide a last broadband link to end-users that are already proximate to (within ¼ to ½ of a mile of) fiber optic nodes or other modes of broadband services. *In other words, the electric line acts as a means of distribution, not as a long-haul carrier; even then, the signal must be regenerated frequently (every 1,000 to 3,000 feet) with repeaters.*

Some have viewed BPL as a relatively economical means of providing service to smaller numbers of closely-spaced users. A good example is Central Virginia Electric Cooperative, which is initiating service on a pilot basis to a rural area. However, this approach is financially viable only if enough customers (e.g., a residential subdivision) are located sufficiently close to a point where a signal can be injected from a long-haul broadband medium to the electrical system. *Under the current state of technology, BPL is both density- and distance-sensitive; as in other utilities, scale economies apply.*

The Task Force has yet to be presented with a technical solution that would extend BPL to widely dispersed rural users, each miles apart from the others. However, technology may advance to the point where rural BPL may become possible. We remain optimistic that sufficient rural demand will drive innovation and help make broadband access a reality for rural areas. We will continue to monitor rural BPL developments throughout 2005.

BPL Projects and Deployment

To date, BPL's apparent technological potential has induced a variety of electric utilities to deploy it throughout the United States, in most cases on an experimental or "pilot" basis. The most notable examples of the few full-scale commercial deployments are those by Cinergy in Cincinnati, Ohio and

[13] Commissioner Copps also criticized the unduly technical scope of the rulemaking, arguing that the FCC should have gone on to address "issues such as universal service, disabilities access, E911, pole attachments, competition protections, and, critically, how to handle the potential for cross-subsidization between regulated power businesses and unregulated communications businesses." Statement of Michael J. Copps at 2, *Carrier Current Systems, including Broadband over Power Line Systems*, ET Docket No. 03-104; *Amendment of Part 15 regarding new requirements and measurement guidelines for Access Broadband over Power Line Systems*, ET Docket No. 04-37 (Oct. 28, 2004).

the municipal utility in Manassas, Virginia. In late 2004, NARUC surveyed the States regarding BPL deployments; the detailed results of that survey are included as Appendix B to this report.

IV. SECURITY

A premise of this discussion is that the concepts of security and reliability are intrinsically related. In the electricity context, reliability typically means that customers can obtain a given quality and quantity of electrical energy, more or less on demand, within the parameters specified in national electric reliability standards, quality-of-service rules enforced by State regulators, and utility tariffs. The concept of reliability directly triggers security concerns, as the greater part of modern-day society, including services integral to health and well-being, simply does not function without a reliable supply of electricity (or reliable emergency backup power when normal distribution is interrupted). Other utilities and networks are highly dependent on electricity. If an interruption occurs, arrangements must be in place to ensure that hospitals can continue to provide care, traffic signals continue to work, water and wastewater are pumped, public transportation systems run, emergency communications are effective, economic losses and disruptions to businesses are minimized, and so on.

The events of September 11, 2001 and August 14, 2003 provide dramatic illustrations of the relationship between security and electric reliability. However, disruptions on a smaller scale also raise concerns. The growing reliance of the economy on complex and integrated information and data processing has increased the demand for a higher quality of reliable power and simultaneously reduced customers' tolerance for even momentary electricity outages.

A discussion of BPL's implications for security would not be complete without acknowledging radio interference issues. Emergency response capabilities in use today often depend upon unlicensed frequencies to maintain communications. As noted earlier, these issues have been entrusted to the FCC, which has promulgated its Part 15 rules to accommodate the needs of users of unlicensed frequency.

Enhanced Electric Utility Reliability and Security

Even though BPL is commonly viewed as a communications technology that uses electrical power lines, it has tremendous potential for enhancing the operability of the electric grid itself. An excellent example of potential technological synergy, communications capabilities embedded within the electric system could make possible dramatic enhancements in the efficiency and reliability of electric utilities' power operations. The ultimate goal in this respect is development of the "intelligent" or "smart" grid." A very useful explanation of the smart grid concept appears in a June 2003 report authored by the Smart Grid Working Group of the Energy Future Coalition.[14]

The term "smart grid" refers to an electricity transmission and distribution system that incorporates elements of traditional and cutting-edge power engineering, sophisticated sensing and monitoring technology, information technology, and communications to provide better grid performance and to support a wide array of additional services to consumers. A smart grid is not defined by what technologies it incorporates, but rather by what it can do. The key attributes of the 21st century grid include the following:

[14] The report can be found at http://www.energyfuturecoalition.org/full_report/app_smart_grid.pdf.

- *The grid will be "self -healing."* Sophisticated grid monitors and controls will anticipate and instantly respond to system problems in order to avoid or mitigate power outages and power quality problems.
- *The grid will be more secure from physical and cyber threats.* Deployment of new technology will allow better identification and response to manmade or natural disruptions.
- *The grid will support widespread use of distributed generation.* Standardized power and communications interfaces will allow customers to interconnect fuel cells, renewable generation, and other distributed generation on a simple "plug and play" basis.
- *The grid will enable consumers to better control the appliances and equipment in their homes and businesses.* The grid will interconnect with energy management systems in smart buildings to enable customers to manage their energy use and reduce their energy costs.
- *The grid will achieve greater throughput, thus lowering power costs.* Grid upgrades that increase the throughput of the transmission grid and optimize power flows will reduce waste and maximize use of the lowest-cost generation resources. Better harmonization of the distribution and local load servicing functions with interregional energy flows and transmission traffic will also improve utilization of the existing system assets.[15]

The report explains how the smart grid could enhance security and reliability. While promising dramatic improvements, the smart grid currently remains a futuristic concept. Some of the enabling technologies may actually exist or appear in various stages on the drawing board, but they are not yet widely deployed. In this respect, the smart grid is much like BPL itself; both concepts are technically viable but neither has been widely deployed. Viewed in context, BPL could become one of many enabling technologies that could help to turn the smart grid a working reality.

Most of the presentations and literature reviewed by the Task Force have focused on BPL as a communications technology that would enable electricity customers to obtain broadband service. Typically, utilities undertaking BPL as a business opportunity (to earn additional revenues from communications services) put it in place on a small scale, so as to minimize risks. Most utilities that have actually deployed BPL service follow this profile.

Less discussion has centered on how BPL will facilitate enhanced utility network operations as conceptualized as smart-grid applications. Some observers have suggested that BPL could prove to have more value as a means of enhancing electric utility operations than as a means of extending broadband. Consolidated Edison Company and Hawaiian Electric Company are examples of utilities that have implemented BPL projects to improve operational capabilities. Mike McGrath, Executive Director of Retail Energy Services for the Edison Electric Institute (EEI), advised the Task Force that electric system enhancement is the primary objective for roughly half of the investor-owned utilities interested in BPL. He pointed out that other non-BPL communication technologies can also contribute to electric system enhancement. Others at the October 24, 2004 Task Force meeting asserted that every electric utility pursuing BPL is actively interested in system enhancement, despite the apparent focus on small-scale roll-outs for revenue enhancement. According to Current's Jay Birnbaum, Cinergy, which may have the most extensive rollout of BPL-enabled broadband service to electric customers, remains vitally interested in BPL's potential for improving electric service. Although Cinergy has not yet implemented system-wide applications, it is pursuing them and might not have started down the BPL path were it not for the promise of enhanced operations.

[15] *Id.*

Work by the Electric Power Research Institute's (EPRI) IntelliGrid Consortium has focused on an open-source communication architecture and how communication between elements of the power supply system could be handled so that smart devices can tie into any available communication medium. BPL can be an enabling technology in support of these smart systems. Analysis suggest that a communications system that enables better management of power use and demands could be roughly worth seven times the initial expenditure.[16]

A BPL-enabled intelligent grid could have a greater ability to detect and automatically repair potential problems before they occur. It could make the grid less susceptible to terrorists, technological failures, or natural disasters. It also would require these communications capabilities to be seamlessly capable of tapping into BPL, cable modem DSL, WiFi, and WiMax. Metering applications include remote metering reading, meter theft and tampering detection, and net metering. Demand-side management applications include tailored time-of-use pricing and control of customer's electrical systems for load control. Within the power delivery system, the ability to monitor substation and various equipment components could enhance security, as well as allow sensors to detect the potential for equipment failure, facilitate its replacement before an outage occurs, and restore service expeditiously when an outage occurs.

The BPL rollout by the City of Manassas, Virginia, while not rising to the level of the smart grid, is a promising example of how an electric utility can enhance its system monitoring capabilities. According to Allen Todd, the City's Director of Utilities, the Manassas BPL application is somewhat unusual in its primary focus on improving system monitoring. Making high-speed Internet access available to city residents was an added bonus, but not the original impetus for BPL. By installing this communications capability, Manassas can pinpoint where faults and failures are occurring in much finer geographic detail. The City also has converted from manual to automated readings of electric meters to reduce costs and improve accuracy.

Other enterprises formed to exploit BPL as a business opportunity are also touting its advantages as an operational enhancement. Current and Amperion are both providing BPL service in working partnerships with the backing of affiliates of investor-owned electric utilities. Both contend that BPL can provide various enhanced operational capabilities.

BPL customer service and applications should consider both the range of "value-added customer services" such as Internet access, VoIP, and real-time billing data and energy consumption along with "utility network management," which would include a range of capabilities such as automated meter reading, outage detection, dynamic pricing information, security monitoring, etc.[17] If BPL can be used to enable the communication capability of the power supply system, the benefits of more efficient, secure, and reliable utility operations can be achieved.

Whatever technology is utilized, the potential benefits of the smart grid for both security and reliability are significant, as envisioned and quantified in a July 2004 EPRI report.[18] According to the study, a goal of the power system of the future is to achieve "[p]hysical and information assets that are protected from man-made and natural threats and a power delivery infrastructure that can be quickly restored in the event of an attack."[19] The benefits of the smart grid of the future accrue to both the power delivery systems and consumers, as shown below. These benefits extend well

[16] Clark W. Gellings and Karen George, "Broadband Over Powerline 2004: Technology and Prospects," EPRI, November 2004, p. 17. Citation and analysis used with permission of EPRI.
[17] *Id.* at p. 16.
[18] *Power Delivery System of the Future: A Preliminary Estimate of Costs and Benefits*, EPRI. Palo Alto, CA: 2004, 1011001. Reproduced with permission of EPRI.
[19] *Id.* at p. 2-1.

beyond the security and reliability considerations that are at the center of the Task Force's attention in this report.

Power Delivery (Improvements/ Benefits)	Attributes	Consumer (Improvements/ Benefits)
O&M Cost Capital Cost of Asset T&D Losses	***Cost of Energy (Net delivered life-cycle cost of energy service)***	End Use Energy Efficiency Capital cost, end user infrastructure O&M, End User Infrastructure Control/Manage Use
Increased Power Flow New Infrastructure Demand Responsive Load	***Capacity***	Improved power factor. Lower End User Infrastructure cost through economies of scale and system streamlining, expand opportunity for growth
Enhanced Security Self Healing Grid for Quick Recovery	***Security***	Enhanced Security and ability to continue conducting business and every day functions
Improve Power Quality and enhance equipment operating window	***Quality***	Improve Power Quality and enhance equipment operating window
Reduce frequency and duration of outages	***Reliability & Availability***	Enhanced Security Self Healing Grid for Quick Recovery Availability Included
EMF Management Reduction in SF6 (sulfur hexafluoride) emissions Reduction in cleanup costs Reduction in power plant emissions	***Environment***	Improved Esthetic Value Reduced EMF Industrial Ecology
Safer work environment for utility employees	***Safety***	Safer work environment for end-use electrical facilities
Value added electric related services	***Quality of Life***	Comfort Convenience Accessibility
Increase productivity due to efficient operation of the power delivery infrastructure Real GDP	***Productivity***	Improved consumer productivity Real GDP

Exhibit 4. Attribute and Types of Improvements Assumed in the Value Estimation of the Future Power Deliver System[20]

The EPRI study quantified the net benefits from investing in this futuristic grid[21] The required applications included automation, communication architecture (a key foundation), distributed resources, electronic based controllers, consumer portals, and more. Over and above the investments needed to meet load growth and correct existing limitations, the cost of implementation was estimated at $165 billion over 20 years. This constitutes an annual investment of $8.3 billion above the approximately $18 billion in current annual investment. According to the study, the investment would yield a 20-year net benefit of between $638 billion and $802 billion, or a benefit-cost ratio ranging from about 4:1 to 5:1. Importantly, most of the benefits are attributable to reliability and security, as seen on the following graph based on the more conservative lower bound of the range of estimates. The principal benefits to reliability are the reduction in costs associated with poor power quality and outages that together cost United States consumers $119 billion to 188 billion annually.

[20] Power Delivery System of the Future: A Preliminary Estimate of Costs and Benefits, EPRI. Palo Alto, CA: 2004, 1011001. Reproduced with permission of EPRI.
[21] *Id.*

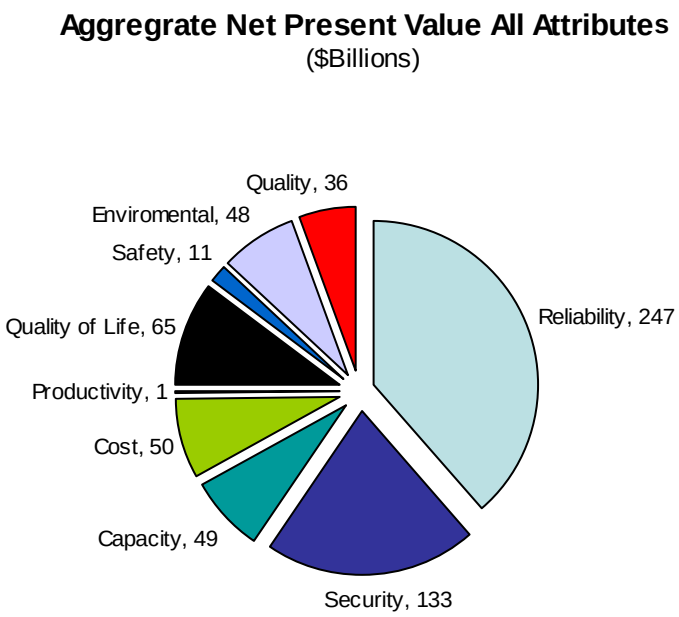

Exhibit 5. Estimated Net Present Worth ($ Billions) of the Improvements for all Attributes Over the 20-Year Study Period (Assuming Primen Lower Bound)[22]
Net Present Worth (5% Discount Rate) = $638 Billion
Annualized Value (5% Discount Rate) = $5.1 Billion/Year

These findings suggest that BPL can help realize a future power supply system that is more reliable, more secure, and better able to meet the technology needs of the future, as well as provide other significant benefits.

System Interdependencies

If BPL providers develop their own equipment and infrastructure, the multiplicity of technologies may result in incompatibility, raising a number of questions: If each provider or electric utility develops its own architecture for a BPL-enhanced smart-grid technology, what would be the effect on the reliability and security of the electric grid as a whole? Could there be a loss of efficiency as different electric systems deploy incompatible equipment? Could scale economies be foregone in the absence of standardized equipment or technologies?

Erich W. Gunther, Chairman and Chief Technology Officer of EnerNex Corporation, is an expert on technological issues who has considered the architectural design needs of a smart grid. In his view, the strength of BPL is that it makes more communications capability available at a lower cost. He believes that BPL is technically viable as a means of making the grid work smarter. According to Mr. Gunther, the sticking point is the little progress to date in addressing how to make the security of a BPL-based technology platform compatible with the dual functions of enhanced electric grid operation and high-speed Internet access. A single system makes both functions interdependent and, as such, creates its own security risks. He contends that the vulnerabilities of electric utility operations and Internet services are different and that the risks of security breaches for each type of system also differ considerably. As a simplistic example, the vulnerability of a BPL-based SCADA system to computer hacking could threaten the electrical supply and disrupt the economies of entire

[22] *Id.* Reproduced with permission of EPRI.

regions. The threat posed by a hacker to a broadband subscriber is also serious, but the harm tends to be more localized. The criminal prosecutions used to deter "conventional" hackers may be inadequate as a means of protecting an entire society against someone intent on jamming the entire BPL system to disrupt electricity service, communications, or both.

Mr. Gunther finds that the development of appropriate software is a possible means of reconciling the security needs of an interdependent system. Encryption of communications signals will probably be part of any solution. In addition, evaluation studies can be used to assess the costs and benefits of potential solutions across the entire range of interdependent functionalities, as well as anticipate obstacles to implementation. Mr. Gunther predicts a solution for BPL-enhanced electric security is at least five years away. He cautions that no technology should be deployed for its own sake.

According to Mr. Gunther, current modes of communications used by electric utilities for their operations are very insecure. They are typically radio-based or rely on closed-circuit lines. A radio signal can be intercepted and a telephone line can be tapped, but either approach requires physical proximity to the communications signal. In contrast, BPL-based communications are not distance-sensitive. Devising an encryption-based solution for BPL could improve the present level of grid security, but only if it is tamper proof.

It should be noted that BPL raises another interdependency issue by combining two public necessities—electric supply and communications services—on a common grid. Unlike plain old telephone service, which can work reasonably well during electrical outages, BPL would be subject to the same degree of interruption as electric service. Thus, moving Internet access and other communications capabilities (such as VoIP) to a BPL platform may diminish the protection afforded through the redundancy built into today's infrastructures.

Finally, regarding cybersecurity, Mr. Gunther advises that BPL raises roughly the same security issues as other forms of broadband communications. One possible exception is some BPL providers' reliance on WiFi to provide a final link to the broadband subscriber. WiFi and other wireless forms of broadband connection present some different vulnerabilities than cable television or DSL access. While these issues are important in relation to such matters as intrusions upon privacy, identity theft, and police surveillance, they are beyond the scope of this discussion of cybersecurity requirements associated with utility enhanced operations using smart grid concepts.

These issues require careful consideration to ensure that one set of physical vulnerabilities would not simply be traded for a set of cyber vulnerabilities. From a security and reliability perspective, the electricity system must be made fail-safe with respect to BPL; electricity must continue to flow regardless of whether the BPL system is operating, damaged, or compromised. Likewise, the implications of an electricity system failure for loss of communications service must be fully understood and appreciated, with appropriate safeguards put into place prior to wide applications. It would be useful to evaluate BPL and other broadband technologies in terms of their comparative implications for security, reliability, and other performance criteria.

V. REGULATORY

The regulatory issues and concerns posed by the deployment of BPL can be divided into two general categories: issues arising from the regulation of electric companies and issues arising from the regulation of communications. Each of these broad categories includes several subcategories, and each involves issues that relate specifically to the federal and State regulation of the two industries. Generally, however, regulatory issues for both sectors overlap and can be organized into five areas of

concern: cost allocation; affiliate transactions; rights-of-way; provider access; and licensing and telephone legacy regulation. Most of these rest squarely within the purview of State commissions.

While this list is certainly not exhaustive, it contains what the Task Force believes to be the crucial regulatory issues surrounding BPL deployment facing State policy makers. The Task Force welcomes input on these and other regulatory issues. While few States have formal dockets open to examine these issues, the Task Force hopes to spend more of its efforts in 2005 formulating a collection of best practices as a reference tool for State regulators.

Cost and Revenue Allocation

Electricity distribution remains a highly regulated function across the States. For the most part, traditional, cost-based rate-of-return methods and standards apply to investment in and cost recovery for the electricity distribution companies. If and when the distribution system is used to provide another unrelated service, traditional regulatory questions arise regarding allocation of costs and revenues.

One key question presented to State policy makers is whether and how to assign an appropriate allocation of the costs of the electric distribution system to BPL service. The telecommunications industry faced an analogous situation when local telephone companies began to install modern switching equipment, which came with the vertical features, functionalities, and capabilities that made possible, among other things, such discretionary services as call waiting and caller ID. Sensing a new revenue opportunity, telephone companies began to market these new, nontraditional, discretionary services to their plain old telephone service (POTS) customers; many faced competition from inside and outside the traditional telephone industry. Arguments for allocating only the negligible incremental cost of providing the vertical telecommunications services[23] were countered by arguments that these discretionary services should bear their share of fully allocated costs. By allocating costs in this manner, the vertical services would fund some portion of the investment in local switching, help subsidize universal service, and help keep the cost of POTS affordable.

Comparable questions arise for BPL, which for the present involves mainly small pilot programs. As deployment becomes more widespread, cost allocation issues will come to the fore, particularly if raised in the context of electric rate cases. Based on historic cost accounting principles utilized by many regulatory commissions, the direct costs of BPL and that portion of the common costs of the distribution system attributable to BPL probably should not be supported by core electric ratepayers; rather, these costs should be imputed to BPL service. If these costs are not removed from electric rates, the captive electric ratepayers would arguably subsidize the deployment of BPL and also bear a degree of risk for what could be a speculative venture.

The question differs somewhat, but not entirely, if the electric utility uses BPL in whole or in part for its own operational purposes. Some electric companies may see BPL principally as a valuable communications options to offer their customers. Others appear far more interested in the use of BPL technology as a stepping stone to the "smart grid" or to otherwise enhance their electric

[23] Basically zero or close to it, given that the cost of investing in the new switching equipment was largely fixed. *See, generally*, Kahn, Alfred E., Letting Go: Deregulating the Process of Deregulating, (MSU 1998) at 83-89 as perhaps the best known and strongest proponent for minimal allocations. An interesting aside is found in n. 112 page 83 of this book, where Kahn suggests for any direct transfer/divestiture of assets that "purchasers of regulated services would, indeed, be entitled, under *original cost regulation* to any capital gains – the difference between depreciated acquisition costs and sales prices – on any assets sold or otherwise transferred: the same would seem to apply to access transferred to an unregulated affiliated entity."

distribution capabilities, as discussed earlier. Several commentators have suggested that the benefits of enhanced operations—to both the company and its customers—may with time cover most if not all of the expenses related to deployment. Improving system reliability and the efficiencies gained through the use of remote load management, outage detection and management, customer notice, trouble reporting, and the like will likely be used to justify investment in the technology.

Using a fully allocated cost methodology, BPL would fund a portion of the distribution system's investment and maintenance cost and lower costs allocated to electricity use.

Using an incremental-cost methodology, the costs of entry into the BPL market would likely be lower (as in the example above), making broadband availability thus more ubiquitous and more affordable to the communications customer.

Traditionally, regulated utilities that engage in unregulated activities (assuming no divestiture) generally are required to segregate costs and risks to protect core customers. Sometimes, however, revenues from unregulated activities are used to reduce the cost of regulated electric service. If the embedded distribution system cost of BPL is fully allocated, some argue that any revenues derived from BPL should fall to the unregulated side of the electric utility business and not be used to offset electric rates. The allocation question becomes more complicated for utilities that also use the technology for the benefit of the regulated electric utility business (as in "smart grid" applications, remote meter readings), as well as for retail broadband service (whose customers may but are not necessarily in all cases also electricity customers). In that case, some suggest BPL costs could be carefully allocated to both regulated and unregulated functions, based on burdens and benefits.

Regardless, costs must be somehow recorded in the system of accounts prior to judgments about their allocation.

Various stakeholders have expressed views on cost allocation issues. EEI contends the costs of BPL to utilities may include labor, equipment, management, and reasonable fees to ensure removal of the system, if required. EEI also asserts that:

- Costs incurred for the benefit of improving the operation of the electric system should be allocated to regulated customers just as any other electric system investment would be allocated; and
- Remaining costs should be allocated to the BPL activity, and recovered from the activity or the provider.

The Power Line Communications Association (PLCA) suggests that State commissions:

- Require BPL affiliates to pay their share of fully loaded incremental costs of BPL deployment;
- Require a level playing field: DSL and cable modem only pay incremental costs of POTS and cable television networks; and
- Not require BPL affiliates to bear any sunk costs in the existing network.

The National Energy Marketers Association (NEMA) posed several questions regarding BPL cost allocations:

- What specific costs are associated with using space for BPL?
- What other costs should fairly be allocated to the space used by BPL?

- Should BPL customers pay twice for system maintenance or upgrades included in rate base?
- Who owns the unused space on power lines?
- Who should receive revenues from the use of this space?

Some BPL providers and electric companies have argued that if regulators choose to impose limits on BPL revenue retention, the earning potential of a company for providing the service may not be sufficient to motivate investment. However, many States have rules, methodologies, precedents, or statutes in place that address fairness in cost allocation and revenue sharing. The Task Force realizes that, as with other similar accounting or allocation issues, a one-size-fits-all answer may not be suitable for all States. The Task Force plans a continued focus on this issue so that reasonable alternatives can be offered for individual States to consider.

Affiliate Transactions

Another cost allocation issue concerns affiliate transactions. Generally, State rules and/or law prohibit electric companies from cross-subsidizing their non-regulated activities with monies collected from captive ratepayers. In all likelihood, this restriction would apply to BPL communications services as well. State regulators are rightly concerned about potential cross-subsidization issues, including the unlikely possibility that captive electric ratepayers may be forced to subsidize a failing BPL business though, *inter alia*, an increase in the cost of capital, to save the core utility as a whole.

While cross-subsidization is a concern to captive ratepayers within the regulated electric utility, it is also a major concern to competitors in the communications industry. When a company can subsidize its competitive product or service, its behavior is anti-competitive because it enjoys an unreasonable advantage over competitors. If costs and revenues related to BPL are not allocated properly, one service will likely subsidize the other. Unless tangible benefits are perceived to accrue fairly to all ratepayers, ratepayer advocates will likely object, but competitors using different technologies will certainly point to a regulatory tilt in favor of the subsidized service.

One approach to protecting ratepayers (and competition) is to require structural or functional separation between the regulated electric company and its affiliate BPL provider. Structural separation could provide protection in the event of a catastrophe, but it does not avoid the cost allocation challenge described above (that is, the allocation of embedded or marginal costs to the respective services). Moreover, structural separation could result in unnecessary duplication of resources and defeat some of the other efficiencies that could otherwise be gained by electric companies providing BPL. Structural separation would most certainly add to the utility's cost of market entry.

An alternative approach would be to impose functional separation, using appropriate accounting rules, to facilitate cost allocation and guard against cross-subsidization. Participants in the regulatory process often disagree about whether the residential class is subsidized by the commercial and industrial classes, and whether such subsidies are justified. However, subsidy of unregulated activities is not accepted. New protective accounting techniques in this regard are ring-fencing and firewalls.

Regarding affiliate transactions, EEI has stated that:

- A public utility commission's review should be limited to review of the utility's transactions alone;
- Specific BPL regulations are counter-productive;
- All BPL providers, including affiliates, should be free to set rates and terms based upon market conditions; and
- Affiliate transaction rules should not prohibit using the "scope and scale" of the utility–including the use of the utility's name.

Cinergy specifically points out that its wholly-owned subsidiary, The Cincinnati Gas & Electric Company (CG&E), provides access to its electric distribution network to a joint venture between Current and another Cinergy subsidiary, Cinergy Broadband. This venture, which operates under Current's name, is an unregulated broadband provider. Through the arrangement, Current utilizes few CG&E assets and pays the legally required rate for those it does use. As a general rule, Current does not rely on the utility for other assets or services. For example, the customer-care operations of CG&E (billing, credit, collection, and call centers) are not used for BPL operations. In addition, Current uses CG&E-approved contractors, retained and paid for directly by Current, rather than CG&E line crews. Similarly, when CG&E employees provide other services to Current, such as by assisting in safety evaluations of BPL equipment designs, CG&E employees keep track of their time using accounting codes used to bill to the joint venture at CG&E's fully allocated cost. Finally, Cinergy notes that any affiliate requirements established by the Public Utility Commission of Ohio pertain to its BPL deployment in the same manner as it is applied to any other non-regulated affiliate of Cinergy.

In many of the current deployments of BPL, electric utilities have sought to structure their business relationships with non-affiliated BPL providers through arm's-length contractual relationships. A good example of this type of arrangement is Consumers Energy Company, which is planning a BPL deployment in Grand Ledge, Michigan. Gerald D. Wyse, an engineer with the company, observed:

> "We have no intention of getting into the communications business, but we are going to be a landlord for communications companies. Our own business will remain that of an electric utility, with poles and wires. Because our relationship with communications providers will be entirely at arm's length, we foresee no affiliate transaction issues."

If this trend become the norm, many if not most of the affiliate transaction issues could become moot, as the utilities collect negotiated rents for using their facilities and free their BPL partners to market broadband service and manage retail broadband relationships. This idea also lends credence to the many electric companies that have clearly stated that they intend to continue to focus first and foremost on their electricity operations. Deployment is not extensive at this point, but no evidence has emerged to suggest that electric companies are profiting unfairly at ratepayers' expense. This will remain an issue that State policy makers will want to continue to monitor and, where appropriate, communicate clear expectations and policies.

Easements and Rights-of-Way

The Task Force did not hear much concern on behalf of providers or electric companies regarding problems with easements and rights-of-way, although all parties seem to agree that these remain fundamental issues—especially for new competitors entering local areas. Perhaps due to the fact that

almost all of the small-scale BPL deployments involve commercially-negotiated agreements, this issue has not been as controversial as it has become for competitors providing other types of broadband access.

EEI has suggested that local jurisdictions may see BPL as an opportunity to increase rights-of-way or franchise fees for electric service, even though there are no significant additional impacts on land use due to BPL deployment. According to EEI, because BPL piggybacks on existing electric wires and facilities, the argument that it should be free of additional or cumulative franchise or right-of-way obligations has some force. EEI suggests States consider establishing State-wide limits on additional fees and service regulations. Michigan's 2002 broadband law established standardized, limited, State-wide fees for all broadband providers that cannot be increased at the local level.[24] The Task Force plans further scrutiny of right-of-way issues going forward and may provide additional observations concerning possible best practices.

Pole Attachments

Many interested parties commented to the Task Force about pole attachments. The Task Force finds that this is yet another area where State commissions already have in place practices and procedures that should be adequate to address any disputes caused by a BPL deployment.[25]

By and large, if an electric utility provides pole access to affiliates, including a BPL provider, it must provide similar access to its utility poles to other requesters under uniform rates, terms, and conditions. Providing such access will carry with it costs that theoretically should be paid by those requesting access. Regulators must be careful to assure that these costs caused by a competitor's access are not paid by captive electric ratepayers.

Yet the issue of an attachment to an electric pole and the potential to affect crucial electricity service add a layer of sensitivity and complication perhaps greater than that with telecommunication and cable interconnections. Many commentators have noted that an electric utility's primary responsibility is safe, reliable, and efficient delivery of power. Attachment issues presented by the provisioning of BPL should in no way compromise a utility's delivery of electricity in any way. As Charles A. Zielinski, former chairman of the New York State Public Service Commission, recently stated:

> "Section 224 of the Communications Act protects this policy. It grants only a conditional right of access to an electric utility's 'poles, ducts, conduits, and rights-of-way' for the facilities of cable television systems and telecommunications service providers, which electric utilities historically have accommodated. It properly permits an electric utility to deny access 'where there is insufficient capacity and for reasons of safety, reliability and generally applicable engineering purposes.' It grants no right of access for the attachment of BPL facilities to an electric utility's distribution lines. Thus, BPL developers initially need to satisfy electric utilities and their regulators that BPL systems will not compromise the safety and reliability of electric power distribution.[26]

[24] *See* Mich. Comp. Laws § 484.3101 *et seq*.
[25] *See generally,* "Pole Attachments: White Paper by an Ad Hoc Group of the 706 Federal/State Joint Conference on Advanced Services" (NARUC July 2001).
[26] Charles A. Zielinski, "Barriers to Entry: The Fight Against Power-Line Communications," Public Utilities Fortnightly. December, 2004, pp. 19-20.

EEI has suggested that pole-attachment arrangements and fees should be the result of a market-based decision between willing buyers and sellers, further urging that pole attachment fee regulation should be avoided.

NEMA has asked whether the utilities should be able to charge non-approved rates for access, and has questioned whether or not there should be uniform pole attachment formulas.

Cinergy states that Ohio, like many other jurisdictions, already has in place pole-attachment (and conduit) fees to govern use of poles by phone and cable companies. Therefore, Current obtains pole attachments at tariffed rates, and on nondiscriminatory terms and conditions; obtains conduit and collocation space on the same terms CG&E make available to other requesters; and pays for power to run its BPL network devices at tariffed rates.

And the PLCA suggests that State regulators:

- Should require BPL affiliates providing telecom services to pay telecom pole attachment fees for installations outside the electric space; but
- Should NOT require BPL affiliates to pay pole attachment fees for installations inside the electric space.

The Task Force will continue to examine pole-attachment issues associated with BPL and the related topic of provider access, discussed below. The Task Force seeks to ensure that pole attachments are allowed where feasible and appropriate and that the commensurate rates do not become an undue barrier to entry for new BPL providers.

Provider Access

The broader concept implicated by the pole attachment issue is that of making reasonable access available in general to all who want it and are willing to pay for it. Put in a BPL context, the access question is whether any and every provider seeking to use an electric utility's wires for BPL-based communications service should be entitled to get it.

Many have touted BPL as the crucial third-wire option for what can be accurately described as a wireline duopoly in broadband. The other current players are Digital Subscriber Line service provided by local phone companies and cable-modem access. Many argue that existing wireless and satellite broadband technologies, because of their inherent price and technical limitations, do not provide significant competitive pressures in broadband service markets. But, *however the market is defined*, BPL clearly has the potential to significantly enhance competition for broadband services.

In theory, all technologies should be regulated equally, allowing a level playing field on which the various alternatives can compete fairly. Given that DSL and cable modem services are currently not subject to the same degree of regulatory oversight, it may not seem to matter which course is taken with BPL. But variations in the degree of regulation will always matters. The rules that apply will invariably impact the availability of a technology, the price and terms of service, and how well the technology competes.

Because it is a nascent technology, regulation of BPL could follow the hands-off regulatory approach currently applied to cable. At least in the near term, providers of BPL would not be obliged to provide nondiscriminatory access to their physical networks to competitors. This would level the playing field between cable and BPL, but still leave the incumbent telecommunications providers subject to the access related obligations imposed by federal regulation. The FCC's recent actions in

relieving incumbents from physical access requirements for "fiber to the premises" evidences a significant retreat from this federal policy. Overlapping the problems associated with those that want physical access to a carrier's facilities is effective customer access to providers of information services that are not affiliated with the BPL provider.

Some argue that an uneven playing field is acceptable, in that requiring open access is appropriate with existing sunk investment, but not for prospective investment by would-be competitors. Unfortunately, while this argument might apply to new broadband infrastructure, it is less applicable to an electric utility with existing distribution plant. An alternative approach, perhaps acceptable because new entrants need not completely build out new plant, would be to free all providers from open-access obligations. Obviously, such a course of action should not be taken without an examination of the impact of removing those obligations on customer choice. This appears to be one of the key issues facing Congressional leaders in the upcoming rewrite of the federal Telecommunications Act.

NEMA has argued for mandatory open access controlled by FERC jurisdiction. Regarding technology-based competition, the association asks:

- Will the fastest, best, and lowest cost provider to win?
- Are utilities the best innovators of Internet protocol technology?
- Can utilities maximize revenues by maximizing competition?
- Is there a limit to the number of competitors on one line?
- Can advanced technology increase the number of competitors?

EEI has stated that access to the electric system should be negotiated between willing participants:

- Electric utilities do not have market power over broadband services;
- BPL is a nascent technology which will currently not support multiple BPL technologies operating on the same distribution line;
- Mandatory access should not be required at the expense of the safety and reliability of the electric system;
- Attempts to impose mandatory access requirements, if successful, may conflict with utility plans to integrate BPL or other communications technology with their electric system operation;
- Mandatory access regulations would not apply to most co-ops and municipal utilities – excluding 25-30% of the population; and
- Mandatory access requirements would require burdensome regulatory action on terms and costs – and could lead to under-recovery of electric or BPL costs recovered from electric service customers.

Charles Zielinski has argued against open access requirements of government-mandated standardization constraints, such as standard nonproprietary protocols (e.g., TCP/IP):

> "…BPL platforms with proprietary protocols and designs different from those employed by cable and telephone companies may facilitate new applications, such as the automated load controls in which electric utilities are interested. Thus, if the policy goal is to encourage economic broadband transport platform entry, regulators should support flexible, creative designs, and should not mandate standardization.[27]

[27] Charles A. Zielinski, *supra*, p. 20.

Interestingly, unlike traditional telecommunications and electric competitors, most BPL providers at this stage of development are *not* requesting any form of open or mandatory access. The technology is nascent, they say, and unlike other advanced telecommunications services, multiple providers are simply not interested in the same pole at this time. For the moment, most also agree that the technology to accommodate multiple providers of BPL service, each maintaining their own adaptive equipment on a single set of electric wires, does not exist. As a practical matter, provider access appears to be a hypothetical issue for now, but one that regulators and the Task Force will need to watch. As referenced earlier, in addition to physical access, another important dimension of this issue is customer access to multiple internet service providers over the broadband network.

At this juncture, the Task Force is not inclined to address open access arguments further. The Task Force was particularly impressed with the sensitivity of electric pole space from a reliability standpoint. Furthermore, as the BPL providers point out, demand for access is not sufficient to engender a fuller discussion on the issue. Some members of the Task Force expressed concerns about foreclosing regulatory oversight of potentially anti-competitive behavior. At this stage of BPL's evolution, however, it appears that commercial negotiations are taking place in a competitively-neutral manner that satisfies the key BPL providers, as well as regulated electric utilities and their respective State regulators.

Licensing and Telephone Legacy Regulation

The most obvious additional obligation that could be imposed by regulators on BPL providers is a requirement to obtain regulatory permission prior to entering the BPL business. Traditional tools for regulating market entry include registration, licensure, or even the issuance of certificates of convenience and necessity. Conceivably, all of the same telecommunications considerations currently applicable to VoIP and Internet issues generally would apply to BPL. Theoretically, these range from no requirement by government for entry to full economic regulation by the government. The Task Force finds that entry requirements for broadband providers should be consistent across providers and should not depend on the underlying technology.

USF

Another regulatory concern affecting the deployment of BPL, and broadband services generally, is whether providers of BPL should pay into the federal Universal Service Fund (USF), and any similar State fund. Phone companies that pay into these funds argue that such an obligation puts them at a competitive disadvantage. Alternative point-to-point voice service providers using VoIP do not currently pay into these funds. They argue that relief from such an obligation is necessary to provide them a needed opportunity to gain a competitive foothold in the business. The issue is challenging. Among the factors to consider: (1) the degree to which requiring contributions to a State and/or federal USF imposes a barrier to entry for potential BPL providers; and (2) the fact that broadband service is not currently funded through the federal high-cost fund. Some argue that if and when broadband becomes eligible for such funding, then it may be an appropriate time to require BPL providers to contribute to a fund as they may also then be able to directly benefit from the program. In all probability, this issue will be one that the FCC and Congress closely examine in terms of the overall debate over the future of the USF.

VI. GENERAL CONSIDERATIONS AND CONCLUSIONS

Looking ahead, John J. Joyce, President and CEO of Ambient Corporation, predicted:

> "2005 is shaping up to be a pivotal year for [power line communications (PLC) and BPL]. It will ultimately be the marketplace that will determine the success or failure of this technology. If the state regulatory environment encourages deployment of PLC/BPL in order to enhance utility operational capabilities, including better management of their assets, as well as supports new product offerings to utility customers, then significant commercial deployments in 2005 should be a reality."

The potential benefits of BPL are certainly manifest. From a reliability, systems operation, and competitive offering perspective, the technology appears promising. As in so many areas, the regulatory environment in general and BPL-related regulatory decisions will affect the degree of interest and motivation of electric utilities and BPL providers in deploying and advancing the technology. Regulatory uncertainty remains a concern for all involved.

In any sector of any industry, regulatory policy should be clearly defined, fair, and reasonably predictable. Investment, business, and consumer decisions are made based on informed estimates and projections. While perhaps impossible to have clearly defined rules and policies to satisfy all industry players and consumers, State commissions strive to do their part to determine complex and controversial issues in a manner that both facilitates technological advancement and protects the interests of core customers. Well deployed, BPL presents a unique opportunity to do both.

Over the coming year, the Task Force will continue to monitor progress in technology innovation, security/reliability concerns, and regulatory oversight. The Task Force recommends State commissioners take the time now to learn more about BPL technology. Policy makers will want to want monitor BPL to see whether and how it actually delivers on its many promises. States with BPL trials or small commercial deployments are encouraged to remain vigilant in their oversight of the offering and to share their observations with the Task Force. Prescribing an anticipatory form of regulation could presume that we can know how technologies and markets will evolve. Regulators also want to avoid favoring any technology over others and thereby distorting the market or impeding innovation. Absent any actual or imminent market failure or other threat to the public interest, however, oversight can be minimally intrusive. For BPL, the Task Force suggests a light-handed approach to regulation with a longer term focus on resolution of the regulatory issues cited above.

In 2005, the Task Force will remain engaged with industry stakeholders and customers, as we look to optimize the benefits of the technology for the public. The Task Force plans to continue to explore regulatory policy issues, as well as to spend more time in 2005 examining rural pilots. Specifically, we expect to:

(1) Continue to monitor the ongoing pilot programs and commercial deployments;
(2) Focus on emerging regulatory issues with an eye towards formulating a best practices guide for State regulators and providing updated surveys on State and industry activity;
(3) Scrutinize rural BPL deployments with a particular emphasis on any emerging technologies and circumstances that can facilitate rollout.

If you have surveys, white papers, studies, or technology overviews you believe may be of use to the Task Force in 2005, please send an e-mail to NARUC's General Counsel, Brad Ramsay at jramsay@naruc.org.

APPENDIX A

CHRONOLOGY OF BPL TASK FORCE ACTIVITIES

This appendix provides a brief chronology of the NARUC BPL Task Force's activities during 2004, with a focus on presentations made by experts and representatives of interest groups. (Unless otherwise noted, dates refer to meetings conducted by teleconference.)

January 26, 2004. **Brett Kilbourne**, Director of Regulatory Services and Associate Counsel for the **United PowerLine Council** (UPLC) made a presentation. (The UPLC is a trade group that represents utilities and providers interested in BPL.) Mr. Kilbourne provided an overview of BPL's deployment to date in the United States and identified relevant public policy and regulatory issues.

February 23. **Alan Stillwell**, Associate Chief, Office of Engineering and Technology, **Federal Communications Commission** (FCC), provided an update on the FCC's issuance of a notice of proposed rulemaking to add BPL-specific requirements to its existing Part 15 rules. **James Bradford Ramsay**, NARUC's General Counsel, provided a regulatory commentary on BPL.

March 15. **Allen Todd**, Director of Utilities for the **City of Manassas**, Virginia, described the city's pilot project and its decision to offer broadband service via BPL on a commercial basis to all of its municipal electric customers. He discussed the options electric utilities have for contracting out the provision of BPL service to other partners and explained that Manassas had opted for a "developer model;" *i.e.*, it installs the devices necessary to provide BPL service over its electric facilities, but contracts all aspects of the retail relationship with BPL customers to a partnering entity in exchange for a share of the revenues. He said that Manassas's business decision to deploy BPL rested on its enhancements to the operation of its electric system, e.g., improved capabilities for monitoring the location of outages, and that the revenues it collected from communications services were a side benefit.

Also on March 15, 2004, **Steve Greene**, Director of Utility Relations and Regulatory Affairs, **Amperion, Inc.**, and **Angel Cartagena, Jr.**, President of Cartagena & Associates, LLP, (and former Chairman of the District of Columbia Public Service Commission), made presentations. Mr. Greene provided an overview of the BPL industry in general and of Amperion's own activities. Mr. Cartagena summarized his article, "Broadband over Powerlines," Electric Perspectives (March/April 2004), which surveys the regulatory issues that BPL is likely to raise.

April 15. The presentations focused on the security implications of BPL. Presenters were **Erich W. Gunther**, Chairman and Chief Technology Officer of EnerNex Corporation, and **Jeff Pillon**, supervisor of the Energy Data, Security & Market Monitoring Section of the Michigan Public Service Commission's Competitive Energy Division. Mr. Gunther, an expert in security issues raised by new or emerging technologies, discussed BPL's security vulnerabilities and possible solutions. Mr. Pillon talked about BPL as an enabling technology for the intelligent grid that promises future enhanced capabilities.

April 29. **Jay Birnbaum**, Vice President & General Counsel, **Current Communications Group, LLC** (Current), provided an overview of Current's plans to deploy BPL, particularly in the area of Cincinnati, Ohio.

Each Task Force working subgroup began to draft its paper discussing its subject area (technology, security, and regulatory). In August of 2004, two of the papers were posted on NARUC's website (www.naruc.org).

July 13. At a General Session of NARUC's Summer Committee meetings in Salt Lake City, Utah, the Hon. **Laura Chappelle**, Task Force Chair, moderated a panel discussion on BPL, which the Hon. **Denise A. Bode**, another Task Force member, participated as a panelist. Lead presenters were the Hon. **Kathleen Q. Abernathy** of the **Federal Communications Commission** (FCC) and the Hon. **Nora Mead Brownell** of the **Federal Energy Regulatory Commission** (FERC), who provided a federal perspective supportive of the development of BPL. Commissioner Bode provided a technological perspective based on the work product of the Task Force's technology working group (for which much credit must go to Steve Wilt of the Oklahoma Corporation Commission Staff). Jay Birnbaum of Current and **Richard Keck**, an attorney with Troutman Sanders LLP, speaking as General Co-Counsel for the **Power Line Communications Association** (PLCA, a trade association of electric utilities interested in BPL deployment) represented the perspective of the BPL industry, advocating for regulatory policies that would promote deployment. **John Hewa**, Assistant Electric Director of the **City of Manassas**, provided a municipal utility's perspective.

July 29. **Howard Scarboro**, President and CEO, and **Gregory J. Kelly**, Member Services & Business Development Manager, both of **Central Virginia Electric Cooperative**, made a presentation describing their cooperative's introduction of BPL service. Their presentation was of interest in part because it spoke to the potential for BPL to provide service in rural areas. **Craig G. Goodman**, President of **National Energy Marketers Association** (NEMA), began a presentation regarding technological advances and innovations that promise to carry BPL beyond its current applications as a means of enhancing the provision of electric service.

August 23. Mr. Goodman completed his presentation that was truncated during the July 29, 2004 conference call. He urged the FERC to take a hard look at the jurisdictional issues posed by BPL. **Barry Goodstadt** of **WirthlinWorldwide**, a marketing research firm, and **Llew Davies** of **Davies Associates Incorporated**, a management consulting firm, detailed factors that would make a business case for investing in BPL deployment.

September 16. Presenters were **William J. Grealis**, Executive Vice President, **Cinergy Corp.**; **Gerald D. Wyse**, Manager of Distribution System Planning & Performance – West, **Consumers Energy Company** (Consumers); and Mike McGrath, Executive Director, Retail Energy Services, **Edison Electric Institute** (EEI). Mr. Grealis explained the business and regulatory thinking behind Cinergy's decision to form a partnership with Current to roll out broadband service to electric customers in the greater Cincinnati area. (To date, the Cinergy/Current partnership accounts for the single largest number of retail customers subscribing to BPL service.) Mr. Wyse explained Consumers' approach to partnering with a communications provider in starting a pilot program in a portion of its electric service territory encompassing Grand Ledge, Michigan. Mr. McGrath discussed EEI's concerns regarding regulatory policies that would provide incentives for its membership of investor-owned electric utilities to undertake BPL ventures.

October 24. The Task Force convened its only in-person meeting to date, in Arlington, Virginia, immediately prior to the NARUC/NECA National Summit on Broadband Deployment III. Commissioner Chappelle opened the meeting and introduced **Bruce Franca**, Deputy Chief of the FCC's Office of Engineering and Technology, and **David Tobenkin**, Attorney-Advisor of the FERC's Office of Market Oversight & Investigations, to provide a perspective on the FCC's Part 15 rulemaking decision and the joint FCC/FERC statement regarding BPL, both announced on October

14, 2004. NARUC's **Brad Ramsay** provided an overview of the regulatory approaches confronting the Task Force.

The Task Force also heard from a diverse array of panelists during its Arlington meeting. **Paul Rinaldo**, the Chief Technology Officer of the **American Radio Relay League** (ARRL), provided a cautionary note regarding radio frequency interference. He noted that those concerns go both ways: just as interference caused by BPL can impair other unlicensed uses of spectrum, e.g., ham radio, those uses can also interfere with BPL's functionality. Craig Goodman of NEMA urged the Task Force not to foreclose the possibility that BPL systems could, with technological advances, accommodate multiple broadband providers in an open access regime. The UPLC's Brett Kilbourne reminded the Task Force that the response of State regulators would be a critical determinant affecting whether BPL will become commercially successful. Richard Keck urged States to be pro-active in encouraging BPL and to ensure a level playing field for BPL to compete with other broadband technologies. EEI's Mike McGrath outlined utility industry recommendations dealing with safety and reliability, access to the electric system, cost allocation, affiliate transactions, and other issues. **Scott C. Cleland**, Chief Executive Officer of **The Precursor Group**, opined that BPL was at a "viability tipping point." He said that State regulators should not over regulate BPL or attempt to pick winners and losers. Thereafter, Commissioner Nelson conducted an interchange of views with the panelists, Task Force members, and others in the audience.

Coincident with the National Summit on Broadband Deployment, Jay Birnbaum of Current hosted several Task Force members and other State commissioners on a visit to Current's BPL demonstration site in Potomac, Maryland. The site is a residence that has been outfitted with BPL capabilities that provide an impressive array of broadband applications.

November 22. **James Guest**, the FERC's Chief Accountant, made a presentation outlining how the FERC's Uniform System of Accounts might affect accounting and cost allocation issues related to BPL.

December 15. **Robert J. Howley**, Regulatory Affairs, **Cox Communications, Inc.**, made a presentation on pole attachment issues. The Hon. **Alan R. Schriber**, Chairman of the Public Utilities Commission of Ohio, followed up with some observations about pole attachment issues related to the deployment of BPL in Cinergy's service territory in Cincinnati and resulting conflicts with other providers of broadband services in that area.

In late November and early December, Brad Ramsay of NARUC conducted a survey of State commissions regarding BPL developments. The results of that survey are attached to this report as Appendix **B**. During this timeframe, the Task Force also made arrangements with **Janice A. Beecher**, Director of the **Institute of Public Utilities, Michigan State University**, to provide proofing services for this paper. These contributions are gratefully acknowledged.

The Task Force also wishes to thank and acknowledge the efforts of numerous State commission staffers, both as valuable contributors to the Task Force's efforts to surmount the BPL learning curve and, in several cases, as contributors to this white paper. The following is a listing of those staffers:

State Commissioners Appointed to Task Force

- Laura Chappelle (MI)
- Thomas Dunleavy (NY)
- Julie Parsley (TX)
- Tony Clark (ND)

- Denise Bode (OK)
- Connie Hughes (NJ)

With assistance from:

- Robert Nelson (MI)
- Alan Schriber (OH)
- Charles Gray (NARUC)

Federal Commissioners that have participated in Task Force efforts

- FERC Commissioner Nora Brownell
- FCC Commissioner Kathleen Abernathy

Staff Support for the Task Force

- David Tobenkin (FERC)
- M. Henry (FERC)
- Rodger Woock (FCC)
- Jeffrey Pillon (MI)
- Kenneth M Roth (MI)
- Karen Feldpausch (MI)
- Illona Jeffcoat-Sacco (ND)
- Charlene Magstadt (ND)
- Dotti Leonard (NJ)
- Jane Kunka (NJ)
- Gary Walker (OK)
- Steve Wilt (OK)
- Joyce Davidson(OK)
- Joseph Witmer (PA)
- Don Jones (TX)
- Sheri Sanders (TX)
- Brad Ramsay (NARUC)
- Debra Scott (NARUC)

APPENDIX B

BROADBAND OVER POWERLINES (BPL)

-- State Survey Results --

February 2005

This short survey was conducted at the request of the NARUC Broadband over Power Lines (BPL) Task Force Chair, Commissioner Laura Chappelle of Michigan. The question was originally posed to State PUC/PSCs on November 19, 2004. The survey contains responses from all 50 States and the District of Columbia.

Responses: **(Listed alphabetically by State)**

QUERY FROM NARUC BPL TASK FORCE

State Commission	Contact Person	Are there any ongoing BPL trials or deployments?	* Location; * Municipality/City/State involvement (?) in trial; * Companies involved in trial; * Number of households involved in trial; * Services being offered/tested: (1) Local Phone Service; (2) Toll phone service; (3) Broadband Internet Access; (4) Auto Meter Reading; (5) Residential Demand Management/Smart Grid/Grid Management? (6) Other?	Does your State have any open proceedings that are examining BPL issues?	Has your state concluded any proceedings on BPL issues?
Alabama Public Service Commission	Gene Hanes, Energy Federal Affairs	Yes	Location: Hoover, Alabama; Municipality/City/State involvement (?) in trial: no; Companies involved in trial: Southern Telecom, Alabama Power Company; Number of households involved in trial: 115; Services being offered/tested: (1) Local Phone Service: not yet; (2) Toll phone service: not yet; (3) Broadband Internet Access: yes; (4) Auto Meter Reading: not yet; (5) Residential Demand Management/Smart Grid/Grid Management: not yet; (6) Other: not yet.	No previous or scheduled proceedings. While there may be other trials in Alabama, the only jurisdictional electric utility the APSC regulates is Alabama Power Company. The Commission has no authority or jurisdiction over municipals or cooperatives.	No
Regulatory Commission of Alaska	Lori Kenyon, Common Carrier Specialist	No	N/A	No	No
Arizona Corporation Commission	Del Smith, Utilities Division	Yes	Location: Cottonwood, Arizona; Municipality/City/State involvement: Cottonwood Town supports the trial. Companies involved in trial: APS, Mountain Telecommunications, Inc., and Mitsubishi. Number of households involved in trial: Ten. Services being offered/tested. (1) Local Phone service - Not yet; (2) Toll phone service - Not yet; (3) Broadband Internet Access - Yes; (4) Auto Meter Reading - Not yet; (5) Residential Demand Management/Smart Grid/Grid Management - Not yet; (6) Other - None.	N/A	N/A
Arkansas Public Service Commission	Arthur H. Stuenkel	No	N/A	No	No
California Public Utilities Commission	Mark A. Vandervelden, CPUC Division of Strategic Planning	No	N/A	N/A	N/A
Colorado Public Utilities Commission	Warren Wendling, Chief Professional Engineer	No	N/A	N/A	N/A

State Commission	Contact Person	Are there any ongoing BPL trials or deployments?	* Location; * Municipality/City/State involvement (?) in trial; * Companies involved in trial; * Number of households involved in trial; * Services being offered/tested: (1) Local Phone Service; (2) Toll phone service; (3) Broadband Internet Access; (4) Auto Meter Reading; (5) Residential Demand Management/Smart Grid/Grid Management? (6) Other?	Does your State have any open proceedings that are examining BPL issues?	Has your state concluded any proceedings on BPL issues?
Connecticut Department of Public Utility Control	Peter Pescosolido	No	N/A	No	No
Delaware Public Service Commission	Constance A. Welde	No	N/A	No	No
District of Columbia Public Service Commission	Ellen Brown	No	N/A	We have opened a proceeding - F.C. No. 1021. That proceeding has not been concluded.	No
Florida Public Service Commission	Rick Moses	Yes	Information received for an August 2004 survey response indicated that Florida Power and Light had a small pilot of 25 connections in the FPL system and planned to add 25 more. There was no charge to customers. Gulf Power reported a trial in Birmingham, Alabama, with less than 200 customers. Progress Energy Florida had a trial in North Carolina where Earthlink Service was offered to 400 customers in Raleigh.	No	No
Georgia Public Service Commission	Leon Bowles, Unit Director, Telecommunications	No	N/A	No	No
Hawaii Public Utilities Commission	Lisa Y. Kikuta, Chief Researcher	Yes	Location: McCully neighborhood of Honolulu, Hawaii; Municipality/City/State involvement: No; Companies involved: Hawaiian Electric Company and Current Technologies (BPL vendor); Number households involved: Four; Services being offered/tested: Testing VoIP, broadband internet, utility applications (see below). (1) Local phone service: Yes (2) Toll phone service: Yes (3) Broadband Internet Access? Yes (4) Auto Meter reading? Yes, testing an IP addressable meter. (5) Residential Demand Management/Smart Grid/Grid Management? No, working with vendor to develop load management switch. (6) Other: Testing utility applications at distribution substation - monitoring current, temperature and voltage measurements/readings, and power quality.	No	No
Idaho Public Utilities Commission	Wayne Hart	Idacomm, a sister company of Idaho Power, the largest IOU in the state, has conducted limited trials at employee residences, and is currently conducting limited technology trials in two subdivisions.	Location: Boise; Municipality/City/State involvement (?) in trial: No; Companies involved in trial: Idacomm; Number of households involved in trial: There were approximately 50 households participating in the trials at the end of 2004. More are expected as the subdivisions build out; Services being offered/tested: (1) Local Phone Service; (2) Toll phone service; (3) Broadband Internet Access; (4) Auto Meter Reading; (5) Residential Demand Management/Smart Grid/Grid Management? (6) Other? At this stage of the tests, only high speed internet services are being provided.	No	No

State Commission	Contact Person	Are there any ongoing BPL trials or deployments?	* Location; * Municipality/City/State involvement (?) in trial; * Companies involved in trial; * Number of households involved in trial; * Services being offered/tested: (1) Local Phone Service; (2) Toll phone service; (3) Broadband Internet Access; (4) Auto Meter Reading; (5) Residential Demand Management/Smart Grid/Grid Management? (6) Other?	Does your State have any open proceedings that are examining BPL issues?	Has your state concluded any proceedings on BPL issues?
Illinois Commerce Commission	Bud Green, Chief Telecom Engineer	No	N/A	No	No
Indiana Utility Regulatory Commission	Joel Fishkin, Assistant. Director, Telecommunications Division	Yes	Location: South-Central Indiana, more specifically, Martinsville, IN; Municipality/City/State involvement: No Companies involved in trial: South- Central Indiana REMC and International Broadband Electric Communications, Inc. Number of households: 1,100. Services being offered/tested: Local phone service - No; Toll phone service - No; Broadband Internet Access - Yes Auto Meter Reading - No Residential Demand Management/Smart Grid/Grid Management - No Other - Outdoor cameras.	No, but we had a workshop.	No
Iowa Utilities Board	John Ridgway, Manager - Telecom	No	No	No	No
Kansas Corporation Commission	Guy McDonald, KCC Staff, Senior Telecommunications Analyst	No	No	No	No
Kentucky Public Service Commission	Jim Stevens, CPA, Telecommunications Revenue Requirements Branch	No	N/A	No	No
Louisiana Public Service Commission	Eve Kahao Gonzalez, General Counsel	No	N/A	No	No
Maine Public Utilities Commission	Phillip Lindley, Utilities Analyst	No BPL activity in Maine. We are aware of contacts between a BPL supplier (Main.net Communications, of Reston, VA) and one of our small municipal electric utilities, but no trials are planned as of yet.	N/A	No	No
Maryland Public Service Commission	Carlos Candelario, Assistant Director, Telecommunications	Yes	There is an ongoing trial in Potomac, Maryland. It involves the private firm called Current Technologies, which is using PEPCO facilities for the purposes of transmission. There is no government involvement at any level. There are 100 residential customers involved and the two services being trialed are internet services and auto meter reading.	There are no open proceedings or proceedings that have been concluded on BPL issues in the State.	No

State Commission	Contact Person	Are there any ongoing BPL trials or deployments?	* Location; * Municipality/City/State involvement (?) in trial; * Companies involved in trial; * Number of households involved in trial; * Services being offered/tested: (1) Local Phone Service; (2) Toll phone service; (3) Broadband Internet Access; (4) Auto Meter Reading; (5) Residential Demand Management/Smart Grid/Grid Management? (6) Other?	Does your State have any open proceedings that are examining BPL issues?	Has your state concluded any proceedings on BPL issues?
Massachusetts Department of Telecommunications and Energy	Ashish Shrestha, Analyst, Telecom Division. & Energy	Yes, trial.	Agawam, MA. Municipality/City State involvement: None. Companies involved in trial: Western Massachusetts Electric Co. is starting up a 25-home trial in Agawam of a hybrid system that carries Net traffic on medium-voltage lines and uses wireless gear for the last-mile connection to homes. Services being offered/tested. (1) Local phone service - No (2) Toll phone service - No (3) Broadband Internet Access - Free high-speed internet access. (4) Auto Meter Reading - the electric company is also exploring using the connections to link its own equipment, including residential meters, to the Internet. This would allow for remote reading of meters or equipment that measures current flow. (5) Residential Demand Management/Smart Grid/Grid Management? See below. (6) Other? The utility could install "smart streetlights" that send a message via the Internet when their lamps burn out. An electric grid with more monitoring devices linked to the utility's operations center could give warning of outages before they occur, officials said.	No	No
Michigan Public Service Commission	Laura Chappelle, Commissioner	Yes	Consumers Energy Company and the Shpigler Group are implementing a pilot project for BPL in Grand Ledge, Michigan in the Spring of 2005.	No	No
Minnesota Public Utilities Commission	Diane Wells	No	N/A	No. Additional Information: Rochester Public Utilities is doing a trial of BPL.	No
Mississippi Public Service Commission	Patricia Trantham	No	N/A	N/A	N/A
Missouri Public Service Commission	Natelle Dietrich: Regulatory Economist III	Yes	Location: Cape Girardeau, Missouri. Municipality/City State involvement: None known. Companies involved in trial: Ameren Union Electric. Ameren has a trial program in this area. Specific details are unknown.	No	No
Montana Public Service Commission	Mike Lee	No	N/A	No	No
Nebraska Public Service Commission	Gene Hand	No	N/A	None. There is proposed legislation (LB 136) titled the "Public Power Infrastructure Act" that centers on the difference between information service and telecommunications service including establishing that the governing body of the public power supplier will be the sole regulator.	No

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Nevada Public Utilities Commission	Charlie Bolle, Manager, Policy Analysis	No	N/A	No	No
New Hampshire Public Utilities Commission	Jody O'Marra, Utility Analyst, III	No	No	No	No
New Jersey Board of Public Utilities	Robert Melendez, Issues Manager, Telecom	No	N/A	No	No
New Mexico Public Regulation Comm.	Michael Ripperger; Telecommunications Bur. Chief	No	N/A	No	No
New York State Public Service Commission	Steven Sokal, Office of Economic Development and Policy Coordination	Yes	Location: (1) Briarcliff Manor, New York project deployed service to two households and involves the Ossining Police Department, Consolidated Edison of New York, Ambient Corporation, and Earthlink. Services being offered/tested: Broadband Internet access, automated meter reading, and other enhanced electric service applications, including substation SCADA control and video surveillance telemetry. (2) Solvay, New York project involves the Village of Solvay Electric Department, New Visions PLC, and Main.net PLC. Services include broadband Internet access.	No	No

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North Carolina Utilities Commission	Teresa Kelly	Yes Duke Power is in the final stages of evaluating its market trial with AT&T Corp., Earthlink Inc., and LecStar Telecom Inc. to provide high-speed Internet to about 100 Charlotte residents for six months. Out of their options is to become a wholesale network provider for existing internet providers, such as EarthLink, Microsoft, and AT&T.	Progress Energy completed its market trial in August 2004 to provide broadband service to about 400 Wake County homes for six months. Currently, the company does not have plans for a large-scale commercial rollout of BPL in the company's service territories. Integrated communications provider Fonix Telecom is partnering through its subsidiary, LecStar Telecom, with Duke Power to expand on ongoing test of broadband over power line (BPL) technology and market acceptance. The trial, which will be expanded to 10,000 to 15,000 homes in North Carolina and South Carolina, represents an expansion of a 500-home trial currently being conducted by the companies. The trial's specific locations will be determined in the first quarter of 2005, and the companies expect service to be available to businesses and consumers in some markets in mid-2005. As part of the BPL trials, Fonix also is continuing to test Voice over IP via BPL. This service will be tested by current trial participants and is expected to become available to all customers in the next phase of the trial by mid-2005.	No	No
North Dakota Public Service Commission	Tony Clark, Commissioner	No	N/A	No	No
Ohio Public Utilities Commission (PUCO)	Alan Schriber	Yes	We have a major BPL program underway in Ohio, specifically in Cincinnati. Cinergy is deploying BPL in certain neighborhoods and is beginning to spread out. They had a successful pilot program earlier. I have visited with Current Technologies, which is doing the "business side" of the BPL and have seen their demo house in Maryland. They now have a demo facility in Cincinnati.	Wars are brewing in Cincinnati between Time Warner, Cinergy, and to a lesser extent, Cincinnati Bell. The big fight is over pole attachments.	No
Ohio Commission	Cheryl Williams, Chris Kotting	Yes, one trial and one trial that has progressed into a deployment. AEP/Amperion (trial) and Cinergy/Current Communications (deployment in progress).	Location: Cinergy's Electric service territory (Cincinnati Area); AEP Facilities in Dublin, Ohio. Also, small REC's and Municipal co-ops (just started). AEP/Amperion: N/A Municipality/City/State involvement: Under Cinergy/Current, only to the extent that Municipal electric operations buy into the product. None have thus far, although some are considering it. Under AEP/Amperion: None. Companies involved in trial: Under Cinergy/Current: Cinergy/Current Communications. Under AEP/Amperion: AEP/Ohio Power, and Amperion. Number of households involved in trial: Under Cinergy/Current, 100 in trial, deployment customer counts unknown at this time. Under AEP/Amperion, None (At this time, the trial is limited to AEP's own facilities). Services being offered/tested: (1) Local phone service; No for Cinergy/Current; No for AEP/Amperion. (2) Toll phone service: No for Cinergy/Current; No for AEP/Amperion. (3) Broadband Internet Access: Yes for Cinergy/Current; Yes for AEP/Amperion. (4) Auto Meter Reading? Testing, for Cinergy/Current; Testing, for AEP/Amperion. (5) Residential Demand Management/Smart Grid/Grid Mgmt: Testing, for Cinergy/Current; Testing, for AEP/Amperion. (6) Other: Unknown, for Cinergy/Current; Unknown for AEP/Amperion.	No	No
Oklahoma Public Utility Commission	Steve Wilt, Public Utility Regulatory Analyst – Telecom.	No	No	No	No

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Oregon Public Utilities Commission	Rick Carter, MIEEE, Senior Telecommunications Engineer	No Currently there are no trial deployments, or network construction of this technology in the State. There is some interest in the technology for use by electric companies for the purpose of Auto Meter Reading (AMR). There is one operator, which serves a sliver of the Eastern Oregon border area near Idaho, who has recently completed a trial deployment in Meridian, Idaho, west of Boise. The Company is IDAComm, which is an affiliate of IDACorp, which also owns Idaho Power. I have talked with the operators of a BPL system in Sault Ste. Marie, Canada, regarding their trial deployment, and several conversations with technical representatives at Amperion, who manufacture equipment for BPL. These discussions took place to help develop a presentation for informing Commissioners of the nascent technology.	N/A	No	No
Pennsylvania Public Utilities Commission	Joseph Witmer	Pennsylvania experience. PPL Telecomm (a subsidiary of PPL Corporation, a major provider of electricity in Eastern and Central Pennsylvania to approximately 1.3 million customers) has been involved with BPL since 1999. PPL originally used Main.net technology supplied by Amperion, Inc., in an experiment in Whitehall, PA, that passed approximately 2,500 homes. PPL estimates that of the approximately 375,000 customers evaluated for potential BPL service, more than two-thirds do not have access to equivalent two-way broadband service. PPL has not yet made a final decision on a full scale deployment.	Pennsylvania involvement at FCC. Pennsylvania was one of two states that submitted comments in the recently concluded BPL docket. The PaPUC suggested that (a) an ancillar NOPR was needed to address non-technical issues, such as universal service and the role of the states; (b) the final regulations should not apply for 36 months to entities deploying BPL as of the date of enactment, unless there is evidence establishing an inability to solve technical issues absent application of any final BPL rules; (c) the spectrum be divided into "notched" or exempt sections (primarily for Verizon, Spring, Boeing, ARR, CSAA, NAS-RAS, and NCTA) and non-notched (non-exempt) sections (primarily all other spectrum); (d) BPL equipment should incorporate state-of-the-art power reduction, frequency modulation, and shut-off devices to mitigate any potential interference; (e) the FCC should create a BPL Engineering Task Force modelled on the Internet Engineering Task Force; (f) procedures should be developed for posting information about BPL in the respective states; and (g) state commission should have the option of "opting in" to be a first-cut mediator for any alleged interference from BPL to customers or entities using spectrum that experiences interference from BPL.	N/A	N/A
Rhode Island Public Utilities Commission	Stephen Scialabba, Chief Accountant	No	N/A	No	No
South Carolina Public Service Commission	Douglas Pratt	No	N/A	No	No

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South Dakota Public Utilities Commission	Bob Sahr, Commissioner	No	N/A	No	No
Tennessee Regulatory Authority	Darlene Standley, Chief of Utilities	Yes	Location: Fayetteville, Tennessee. Municipality/City/State involvement: Yes Companies involved in trial: Fayetteville Public Utilities & GridStream TechnologYes Number of households involved: this trial is no longer active, two approximately three businesses still have modems that are active. Services being offered/tested: (1) Local hone service - No; (2) Toll phone service - No; (3) Broadband Internet Access - Yes; (4) Auto Meter Reading - No; (5) Residential Demand Management/Smart Grid/Grid Management - No; (6) Other - No	No	No
Texas Public Utility Commission	Sheri Sanders, Attorney, Policy Development Division	Yes. Broadband Horizons (BH) is the first company to launch BPL in Central Texas. Initial installations began in June 2004. Its offices are based out of Blanco, Texas. Additional information about their services may be found at http://www.broadbandhorizons.com/index.htm. Additionally, in summer of 2004, TXU Electric Delivery hosted a small-scale BPL retail demonstration project in Irving, Texas, providing five homes with Internet service to test the technical feasibility of BPL. Utility applications were not tested. The vendor withdrew interest. Larger scale commercial deployment is being considered, and TXU is interviewing suppliers, technology partners, and retail ISP providers.	Location: Broadband Horizons' home office is located in Blanco, Texas. It currently has pilot projects in Burnet, Weimar and Blanco, Texas. BH is initially targeting rural and semi-rural communities, generally under 20,000-30,000 population. Municipality/City/State involvement. The City of Blanco is served by Perdenales Electric Cooperative, a private electric utility owned by its customers. The City of Burnet owns its own electric utility. The City of Weimar is served by the Fayette Electric Cooperative, District 6. The current contracts are for limited projects for 90 to 180 days. For the pilot projects, there will be no cost to the muncipal utility districts. Companies involved in Trial: Broadband Horizons and its ISP, Momentum Online.. Number of households involved in trial: The initial pilots are limited in size, and the company reports approximately 25 users on the system, mostly in Weimar, TX. In Burnet, BH provides BPL broadband service to a municipal building and a nearby commercial building. Services being offered/tested: (1) Local phone service - Unknown; (2) Toll phone service - Unknown; (3) Broadband Internet Access - Yes. (4) Auto Meter Reading - Unknown. (5) Residential Demand Management/Smart Grid/Grid Management - Unknown. (6) Other - None.	No	No
Utah Public Service Commission	Peggy Egbert, Technical Consultant, Telecommunications	No	N/A	No	No
Vermont Public Service Board	Peter Bluhm	No	N/A	No	No

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Virginia State Corporation Commission	Steven Bradley, Deputy Director, Division of Communications; or John D. Hewa, Assistant Director Electric Utility, City of Manassas, VA	Yes. Manassas, Virginia was conducting a trial of internet access over BPL. It affected only a handful of customers. As I recall, it was limited to just internet access. I believe that Manassass operates its own municipal electrical service.	1 - Location: City of Manassas, Virginia; Municipal Involvement: Yes; City government involved, specifically the Electric Department; In Trial: No, commercial deployment stage; Number of Households: more than 200 subscribers with over nearly 3,000 homes passed; Services: business and residential internet services, VOIP operational testing at multiple sites; Broadband Access: $28.95 per month for residential with no installation fee and no long term contract; automatic meter reading operational for demonstration purposes, video cameras operational over BPL at electric substations and other sites operating coordinated traffic signals with system, plan to expand Approximate City population 12,500 residences and 2,500 businesses totaling 36,000 people. 2 – Location: International Broadband Electric Communications, Inc. (IBEC, Inc.) of Huntsville, Alabama, is conducting a market pilot of two circuits of the CVEC Colleen Substation located south of Lovingston, Virginia; Municipal Involvement: None to date; Companies involved in trial: IBEC, Inc.; Number of households involved in trial: 64 total users; Services being offered/tested: (1) Local Phone Service – no; (2) Toll phone service – no; (3) Broadband Internet Access – yes; (4) Auto Meter Reading – no; Residential Demand Management – no; Other – no.	No	No
Washington Utilities and Transportation Commission	Bob Williamson, Sr., Technical Staff	Yes, two trials are in progress by Chelan County PUD in rural Eastern Washington State.	One trial is located in Wenatchee Heights, a housing development of approx. 35 homes using capacitive coupling, HPA (Home Plug Alliance) protocol BPL equipment provided by Gridstream. Started in May of 2004 this trial has never fully functional. A total equipment redesign will be completed and the trial will restart early 1st Q 2005. The second trial is in the Peshasin area and connects approx. 30 homes using induction coupling BPL equipment from MainNet providing 500-700Kb of bandwidth. The trial is functional and in use by two customers at this time. Ham radio organizations have assisted in radio interference testing at both locations. using capacity coupled, HPA (Home Plug Alliance) protcol BPA equipment provided by GridStream. Gridstream. Started in May 2004 this trial has never been fully functional. A total equipment redesign ha been completed and the trial is set to begin again the first quarter of 2005. The second trial is in the Peshastin area connecting approx. 30 homes using inductive coupled, proprietary protocol BPL equipment proprietary protocol, BPL equipment provided by MainNet. Fully functional since its inception in September of 2004, this system provides 500-700 Kb of broadband data bandwidth per subscriber. Ham radio operators have assisted with radio interference testing at both locations.		
West Virginia Public Service Commission	Dannie Walker, Technical Analyst	No. American Electric Power was approached by a BPL company in either 2003 or 2004; however, the power company decided against a trial with them because of the repair response times that the BPL company demanded.	N/A	No	No

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Wisconsin Public Service Commission	Scot Cullen Chief Engineer Energy Division	No	N/A	No	No
Wyoming Public Service Commission	Mike Korber, Lead Rate Analyst	No	N/A	No	No