The Business Case for Power Line Communications

By Dan Metz and Karen George

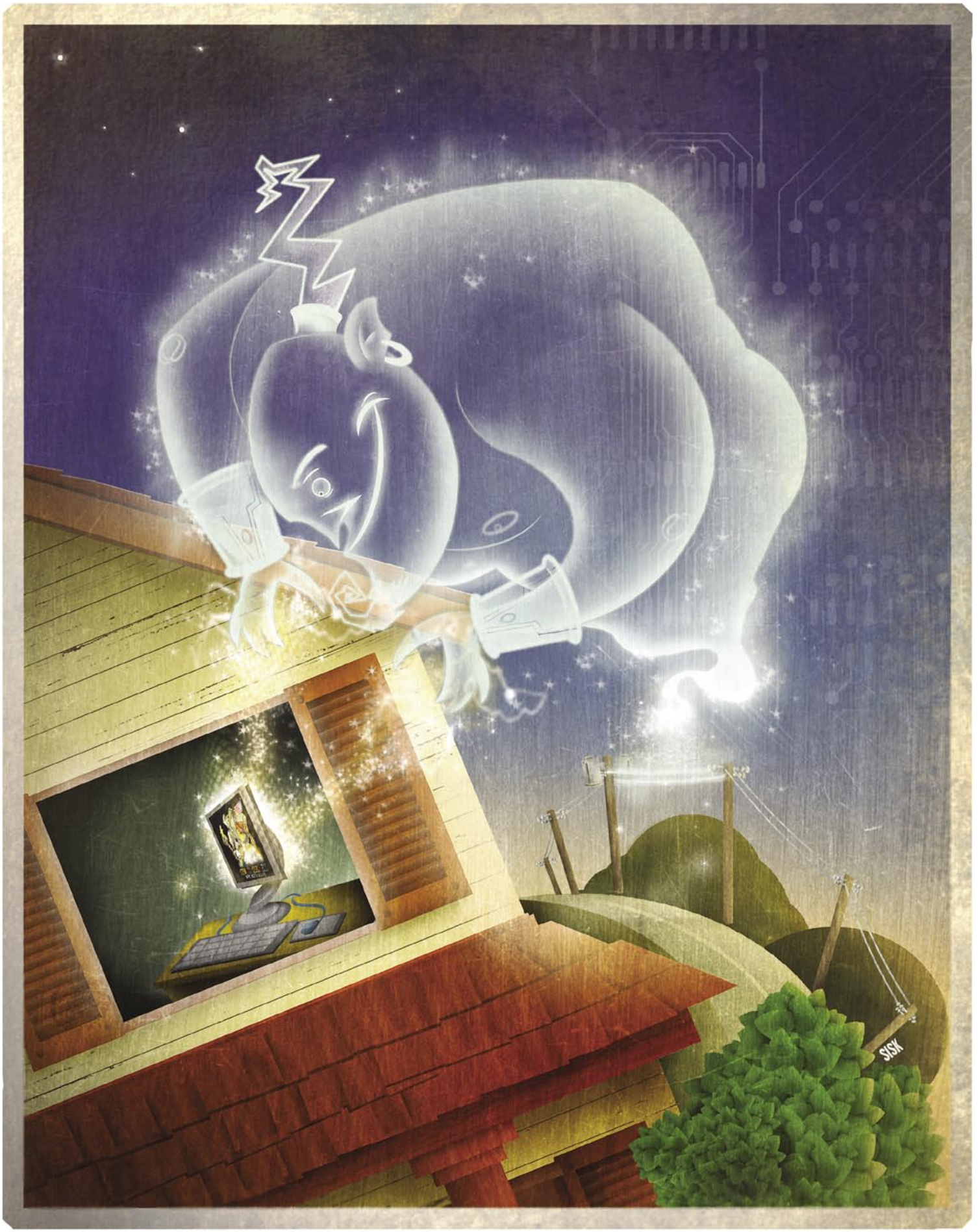
Illustration by Clay Sisk

Some utilities want to use their power lines to bring broadband communications to consumers.

Others see broadband over their power lines as a unique tool to facilitate robust interaction with energy customers who will be able to utilize a new era of energy services.

Increasingly, industry strategists believe that both uses must be pursued to make the business case for broadband over power lines (BPL). Recent research suggests that combining the revenue and cost savings from each could certainly soften the cost impacts for both applications, potentially make BPL much more attractive.

Initial tests and trials conducted by up to three dozen utilities, vendors, and municipalities across the nation have demonstrated that BPL can work. An important task is to determine whether the business case is viable. This entails examination of two potential applications: 1) consumer broadband services such as high-speed Internet access, and related functions, and 2) utility applications with on-grid uses such of monitoring and controlling the system and on-premise functions such as dynamic pricing or usage information.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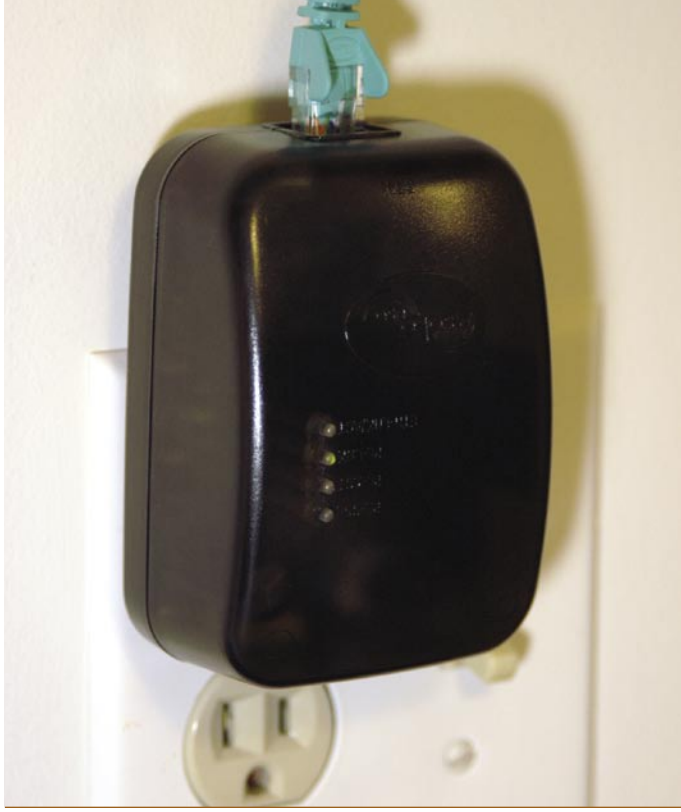

CONSUMER BROADBAND APPLICATIONS

Much attention has been placed on using BPL for consumer broadband services — traditional high-speed Internet access, as well as Voice over Internet Protocol (VoIP), real-time interconnected games, video on demand, streaming video, remote monitoring, security and in-home networking.

The City of Manassas, Va., and Current Broadband in Cincinnati, are deploying commercial-scale BPL networks. They are offering high-speed Internet access initially, and planning to add additional broadband services in the future months. Current Broadband plans to offer VoIP and Manassas expects to offer video on demand in the foreseeable future.

BPL has several attractive features compared to present broadband alternatives. It is fast. The system in Cincinnati offers speeds up to 3 megabits per second (Mbps). The Con Edison pilot (focused on utility applications) has achieved speeds greater than 3.5 to 4.0 Mbps, while Progress Energy has achieved 5.0 to 5.5 Mbps. Speeds of 18 to 20 Mbps have been achieved over the distribution systems, up to the WiFi devices that essentially bypasses line transformers. In comparison, dial-up service operates at 55 Kbps, satellites in the range of 500 Kbps, and DSL in the range of 1.5 Mbps.

BPL vendors express confidence that user speeds with next-generation equipment will exceed 3 Mbps with increasingly faster high speed chips. One vendor predicted 5 Mbps in the near future, and tests to date indicate this should be possible. One chip manufacturer specializing in BPL is introducing a 200 Mbps version, surpassing its present 45 Mbps product.

Another distinguishing feature of BPL is symmetrical speed-identical upload and download speeds — a particular advantage for customers wanting to receive and transmit large files. In contrast, cable offers speeds in the 1 to 3 Mbps range, but only for download. Cable upload speeds are much slower.

UTILITY APPLICATIONS

Utility applications of a BPL communication system include on-premise services for consumers, as well as on-grid applications related to utilities monitoring and operating the distribution system.

The on-grid applications involve basically operating the distribution system—-monitoring things like equipment temperature, loading, status, outage and lightning detection, fault locating, and other "health" parameters, plus control functions like operating station and line equipment as well as generators on the distribution system.

The "on-premise" application, where the utility touches the customer, currently involves functions such as demand response and dynamic pricing, direct load control, disconnects and reconnects, dynamic data aggregation, theft detection, power quality monitoring, communications about usage and billing as well as remote and automated control of end-use equipment.

Expected benefits of utility applications are measured in terms of reduced costs to manage and operate the system, improved reliability through earlier detection and faster restoration of outages, and increased customer satisfaction resulting from improved reliability performance and expanded customer options.

BPL AND THE DISTRIBUTION SYSTEM

EPRI's vision of the power delivery system of the future has powerful characteristics—fully automated, self-healing, flexible, adaptive, and predictive. To fulfill these capabilities, a very robust data communications infrastructure is essential. Today's SCADA systems are a step along the path to that system of the future, but they fall short. There are over 150 different, mostly incompatible protocols.

The power delivery system of the future will consist of many technologically advanced devices and sensors. One device EPRI is developing is the Intelligent Universal Transformer (IUT), essentially a solid-state replacement for present transformers.

Another EPRI development being piloted at 11 utilities is the Distribution Fault Anticipator, (DFA). This system continuously monitors the distribution grid, looking for precursor signals,

Companies Evaluate Broadband

By Rich Maxwell

"I wish they hadn't called it BPL," says Tim Frost, the director of corporate planning at Consolidated Edison (ConEd) in New York. "Broadband is about access and telecommunications. Our focus for BPL is on the internal network." ConEd was an early adopter of BPL, entering discussions with technology developers in 2000.

After several field demonstrations, they have taken a stakeholder position in Ambient Corporation, a BPL technology developer, based in Newton Mass. BPL pilots have included both Internet access delivered via overhead lines, and BPL-enabled remote fault predicting and detect on distribution circuits. Frost says, "Our intentions, going forward, are not to expand the commercial applications. Ambient is doing that. ConEd's plan is to concentrate its R&D on grid optimization."

Last year the New York State Energy R&D Agency (NYSERDA), after seeing the benefits of substation and tunnel demonstrations, awarded additional seed money to ConEd for to expand BPL for sense and respond deployments.

Frost isn't alone. At a United Powerline Council (UPLC) breakout workshop, last September in Arlington, Va., a room full of utility representatives carved out a new agenda for BPL, including the formation of a new committee – the BPL Internal Applications Committee. While ConEd has been cutting its teeth on BPL remote sensing and enhanced data collection, other utilities have used BPL for such grid applications as security and surveillance, automated meter reading and remote substation switch equipment controls.

"Utilities want to know how BPL can enhance systems operations for things like asset management, meter reading, load management and system diagnostics," says Frost, who chairs the new UPLC Internal Applications Working group.

"This 'smart grid' mindset, will have an impact on the commercial BPL," says Brett Kilbourne, UPLC's associate counsel.

Kilbourne speculates that the internal applications are going to drive the vision of BPL commercialization. "Carving out a make-sense business model for BPL inside their network is most important right now for many utilities," he says. "Once they can cost-justify BPL hardware in their network for detection and automation, and all the other applications being talked about, then you will see the commercial side heat up exponentially."

or electric "finger prints," that are telltale signs of impending failures and outages. Trees that are too close to the lines can be detected and crews dispatched before an outage occurs. Similarly, failing lightning arresters, defective capacitor banks, and other equipment can be anticipated—and action taken to avert more catastrophic events.

Two-way communication between the utility and the customer could enable a variety of services that would be of high value to both the customer and the utility, including load control and home management functions. The energy company's consumer gateway could be the home's communications and control hub.

Devices and tools such as these offer dramatic changes to the operation and management of the power delivery system. But these tools and devices must be linked through an equally powerful communications infrastructure. EPRI's work on the communications infrastructure, IntelliGrid Architecture, outlines an open architecture that enables the system of the future, with interoperability across vendors, within and between utilities—a capability essential to a more reliable electric infrastructure. The communications infrastructure for data transmission command and control, in which BPL could play a role, is central to enabling all of the functionalities envisioned in that future system.

UTILITIES ASSESS RISKS

Con Edison and Hawaiian Electric Company (HECO) are vigorously pursuing the utility applications of BPL. Although the costs have been estimated very carefully, each is taking a measured, step-by-step approach to development to mitigate risk. Additionally, cost recovery at utilities is not yet fully known, although the recent landmark FERC-FCC ruling encouraging BPL opens the way for recovery mechanisms. Even in these uncharted waters, the future for BPL utility applications is promising — particularly if the revenue or avoided costs from implementing both consumer broadband and utility applications can be achieved.

Various arrangements are being considered. Through joint ventures retail applications of BPL could subsidize the development of a BPL network that could also enable utility applications.

Of course, confidence in the business case for BPL retail broadband services over the next few years is a key part of determining risk and the business model that makes the most sense. Performance numbers for BPL are more favorable than most present alterna-

tives, but it is reasonable to expect that performance of those alternatives could improve. In fact, fiber-to-the-home networks planned by telecommunications providers, which will be rolled out at 30 Mbps, could pose a considerable competitive threat in some areas. Wireless options such as WiMax, a long-distance, high-speed alternative, may also emerge.

More importantly, competing on price appears risky. Vendors are hesitant to provide specific information, but present general cost quotes for BPL are in the range of $50 to $150 per home passed, and an additional $30 to $200 for customer modems. Over a large area, this can mean investments of millions of dollars.

Will the revenue potential be sufficient to make consumer broadband profitable? One provider is targeting a price of under $20 per month for BPL service. That is attractive compared to DSL in the range of $30 to $49 per month and cable in the range of $39 to $60 per month. This could lead to fairly high market penetrations, which would be needed at the $20 price point. However, in some markets, the word on the street is that DSL could still be viable at $7 per month, so the competition could become very intense, very quickly.

Utilities could face major risks in the retail application if they compete only on the price of consumer services, making the option of partnering or leasing space on lines to commercial providers a more attractive option — and making the case more compelling for realizing cost benefits from using BPL for utility applications.

It is a little early to predict exactly what role BPL will play in the future, but it is clear that it could well be revolutionary.

Dan Metz is the area manager for distribution at the Electric Power Research Institute, and Karen George is research director at Primen, a market intelligence affiliate of EPRI.