UTILITY 2.0

Piloting a Better Future for Maryland's Electric Utilities and their Customers

Submitted to Governor Martin O'Malley

March 15, 2013

by the

Energy Future Coalition

Executive Summary

The Energy Future Coalition was charged by Governor Martin O'Malley of Maryland, in response to a recommendation from the Governor's Task Force on Grid Resiliency, with "scoping out a Utility 2.0 pilot proposal and reporting back to the Governor and the Task Force, by March 15, 2013, on a viable method to explore the contours of the utility of the future." This document responds to that charge.

This pilot design proposes testing (1) the application of new technologies, strategies, and practices in the day-to-day functioning of electric utility service in a pilot project area; and (2) matching changes in utility business practices and reward structures as well as the regulatory scheme under which Maryland's utilities operate. It is intended to be incremental to the many progressive policies and tests of new utility technology and regulation already going on today in Maryland.

This pilot project design presents six categories in which progress toward the utility of the future should occur:

- Reliability and resiliency, aimed at ensuring continuous, high-quality service;
- Residential customer optionality, centered on bringing smart grid information, analysis, control and savings to small customers;
- Large customer optionality, optimizing costs and services for big customers;
- Utility system upgrades, making the grid's technical operations more visible, flexible, and able to convey and react to real-time information;
- Utility business model changes, keeping utilities financially viable even if they deliver less electricity; and
- Regulatory model adjustments, adapting the mechanisms for public-interest oversight and consumer protection to new utility technologies.

For each of these categories, the report presents a statement of the assumptions, facts, and potential that guided the selection of pilot project elements for inclusion in the design. One cannot design a pilot project without having a vision of the future in mind; these categories, taken together, describe elements of Maryland utility service that could be feasible and viable and embrace technology-driven change.

The report identifies individual elements that are recommended for inclusion in one or more pilot projects that might be authorized and carried out in Maryland utility service areas. These recommendations are not specific to particular technologies or technology vendors; they are based on the extensive inputs, conversations, submissions, and research that the Energy Future Coalition reviewed as part of this process. **Table 1** (beginning at page 14) lists multiple pilot project elements that could be part of future operations and opportunities in each of the six categories.

These individual elements are the pieces of a potential pilot project, like the pieces of a jigsaw puzzle; they need to be assembled to achieve a unified result, like a completed puzzle. One or more pilot projects containing these various elements would enable regulators, state officials, and the public to evaluate the feasibility and merits of the following six important attributes that, in the Energy Future Coalition's view, ought to be key aspects of the electric utility of the future:

1. **Aligning utility compensation with customers' changing needs and values.** The proposed project design would adopt a set of five performance parameters that, taken together and evaluated through objective metrics, would be used to vary the utility's rate of return on equity by up to one percent above or below the otherwise allowed return for satisfactory service. The performance parameters would be: cost, reliability, customer service, adoption of smart grid technologies and services, and support for alternate energy. The key innovation proposed here is to base the relative weighting of these factors on customers' own rankings of their importance. This information will provide utilities with a geographically detailed understanding of their customers' priorities, and a direct incentive to serve those priorities. As a second, separate possible innovation, customers' bills could be adjusted based on how well the utility serves their individual priorities. Such a design feature, testable in a pilot project, would provide valuable insight not only on the effect of modifying utility compensation to align it with customer service priorities, but also on encouraging a more positive, less passive, and more mutually beneficial utility-customer relationship, with strong communication going both ways.

2. **Supporting utility investment in an interoperable, integrated suite of smart-grid technologies, not only on its own system, but on the premises of willing customers.** Digitally operated and informed devices are available now for both utility systems and customer applications, enabling a more responsive and efficient system that makes utilities and customers partners in its operation. The pilot project would allow the utility to evaluate and install on its own system a suite of integrated technologies that meet high standards for interoperability and operational effectiveness, and also to provide and install them for willing customers on their premises. The utilities and regulators would endorse, and help customers obtain from their energy suppliers, real-time or highly differentiated time-of-use rates. Customers would then have the ability to optimize their own energy use in response to daily, weekly, and seasonal fluctuations in the cost

of energy. Customers could also choose to give the utility remote access to their power-consuming devices under an agreement that would compensate them, through purchase cost rebates, lowered costs of service, or both, for helping the utility maintain system power quality and reliability in a changing power-supply environment. The utility would need to enhance its customer service to support such customers with technical and efficiency expertise. The costs of the systems would be assigned to the customers accepting them except where the utility system as a whole would benefit from the new flexibility, voltage-regulation potential, and decrease in outages.

3. **Allowing utilities to finance and customers to repay system-related and efficiency investments on their bills**. This step would provide access to up-front capital for customers eager to embrace new smart-grid options or improve their energy efficiency despite lacking the money to invest. Such loans would reflect the utility's own low cost of capital and would be recorded against the property where the installations are made, providing repayment security that would help to justify the utility's continued access to low-cost capital. This would also ensure that the energy efficiency of those properties would be revealed in real-estate transactions, for which utilities could provide requested information.

4. **Optimizing automated system sectionalizing and reclosing to facilitate micro-grids for areas where customers could safely provide their own energy during an outage and achieve other goals.** Automated sectionalizing and reclosing equipment has been demonstrated to increase dramatically the areas of continued service by segregating areas directly affected by a storm-caused outage. Maryland's utilities are already implementing these options; BGE has proposed to include a new project in this pilot design. This same technology could also permit sections of the grid that lack power during an outage to be energized safely by local sources. At a minimum, willing groups of customers could install, or have the utility install, and finance on their utility bills, generation capacity geared toward meeting critical power needs during an outage. Microgrid installations ought to be seen and tested as going beyond back-stop resiliency measures, however; they can facilitate integration of storage, localized system management, integration of local renewable and distributed energy sources, and local demand response. They potentially offer a different basis for future grid control, with utilities operating or coordinating system operations among an integrated set of microgrids, using central resources as necessary to keep them all stable and supplied with energy from conventional and renewable generation. Maryland should use any pilot project opportunity to test the microgrid opportunities beyond mere back-up reliability capability to include separate integration and control of distributed generation, storage, and demand response.

5. **Facilitating electric vehicle deployment and utility benefit from utility-controlled vehicle battery charging.** The potential for rapid growth of battery-electric vehicles in Maryland presents the promise of major new services and new load in a market for power that might otherwise shrink, but could create a problem if this major new load is not served in a controlled and timed manner. Under this project utilities could offer substantial initial-cost vouchers to

purchasers of battery electric vehicles who agree to allow the utility to manage their charging time – not only to maintain and stabilize voltage levels, but also to deal with transient voltage and energy anomalies such as cloud shadows in areas with significant solar penetration.

Using a pilot project to test innovations in electricity service is not a novel concept. Maryland's utilities have already embarked on a significant number of important modernization efforts and experiments, and detailed these for the benefit of this project; they are summarized in the report and the utilities' presentations for the project are reproduced in the Appendix. The EmPOWER Maryland efficiency program already sets high goals for energy efficiency for Maryland's utilities, and Maryland's participation in the Regional Greenhouse Gas Initiative (RGGI) obligates the electric sector to integrate meaningful carbon pricing. The pilot project elements proposed herein are intended to be incremental to those already under way, but may propose steps in the same directions in which other efforts are moving at present.

The pilot project design presented here does not endorse specific technology offerings or the companies behind them, nor does it attempt to specify which utility service areas should be proposed for a pilot project. It does not specify separate projects for Pepco or BGE; indeed, there would be much to gain from similar pilots undertaken in each of the major utility service territories, perhaps using different approaches. Each of the elements proposed would require more analysis, planning, and consideration of alternatives than has been possible during the short period available for preparation of this pilot design. Some might be best considered as extensions or variations on efforts already under way. Any combination of such elements would require further assessment of potentially compounding effects. The Energy Future Coalition recognizes that any implementation of this pilot design would require much further analysis and a considerable period of preparation, in addition to a major effort to communicate its purposes and any costs or risks to the customers invited to participate.

The appendices that follow this report list the individuals and entities who proposed ideas to the Energy Future Coalition and who were willing to be identified, as well as notes and utility presentations from a day-long consultation on the parameters of this project, held on February 1, 2013. The Energy Future Coalition is grateful for their many contributions, but bears sole responsibility for this report.

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Introduction

In September, 2012, the Energy Future Coalition was charged by Governor Martin O'Malley to offer the design of a Utility 2.0 pilot project to model the potential contours of future electric utility service in Maryland, accepting the 11th recommendation of the Governor's Task Force on Grid Resiliency. The Energy Future Coalition had testified to the task force that decision-makers in Maryland should consider and potentially adopt changes intended to go beyond efforts to improve reliability and resiliency of the system to embrace the broader technological, environmental, economic, and competitive trends clearly beginning to revolutionize utility-customer relationships and value propositions across the nation. These changes will be driven by the pace of customer adoption, but will then inevitably affect the business revenue, investments, and competitive environment in which utilities operate, and thus their expectations for income, expense, and ability to reward shareholders. As the utility business profile must change in this expected future, the Energy Future Coalition also recommended that Maryland should reexamine the regulatory model that has bounded the utility-customer economic relationship over many decades, seeking one that matches utility incentives and rewards with values customers recognize and are willing to pay for. [1] The Energy Future Coalition suggested that a real-life pilot project embodying multiple prospective changes in utility and customer options and economics would be an appropriate means of testing the benefits and issues with such changes. The task force and the Governor accepted that idea.

This document is the product of an effort to meet the Governor's charge. It is the result of an effort to gather from a wide variety of sources proposed elements for such a pilot project, to review them for readiness to be put to the test in actual utility service circumstances, and to package a number of elements that appear to fit well together as a preliminary design. It represents a selection of only a few of the many ideas suggested for inclusion by the interested parties who participated in the Energy Future Coalition's process, and those in turn represent only a small part of the possible elements that are begging to be tested in today's evolving electric service market and its rapidly emerging technologies. As such, it should be viewed as one among a myriad of potential pilot project designs, not necessarily the best or the most revealing, and certainly requiring much further effort and many additional decisions prior to actual announcement or implementation of this proposal or some variation of it in the homes and businesses of a selected group of Maryland's electricity customers. Indeed, this report should be viewed more as an effort to give substance to the concept of conducting one or more pilot projects to manage toward the future of electricity service in Maryland and less as a blueprint specifying the contents and operation of such a pilot project or projects.

The pilot project design has been developed with the idea of actual implementation on an unspecified portion of the systems of one or both of the two leading investor-owned utilities in Maryland, Potomac Electric Power Inc. (Pepco), a subsidiary of PHI Holdings, Inc., and Baltimore Gas & Electric Company, a subsidiary of Exelon. These utilities were among the sources of ideas considered in this effort, but have not selected the elements or policies proposed herein for testing in a pilot project, nor have they endorsed or agreed to implement any such pilot on their systems. They are obviously constrained in

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[1] The task force adopted this approach with specific regard to reliability and resiliency investments in its 4th recommendation; this pilot project design proposes extending the approach to other key facets of utility service.

the degree to which they can participate freely in a far-sighted exercise to design a pilot project to reshape their own future operations and interactions with customers, when at the same time they must respond in regulatory proceedings at the Maryland Public Service Commission to current issues with those same operations and interactions. Their willingness to commit their own expertise, resources, and time to such a project to the extent they could, and within too short a period to permit full analysis and reaction, indicates their recognition that major changes are coming and their desire to help identify how those changes can be accommodated in keeping with the public interest as well as their own business interests.

Many other stakeholders, companies, interest groups, and experts have contributed ideas that have been put "into the hopper" in developing the pilot project(s) recommended here; they too bear no responsibility for the selections made by the Energy Future Coalition herein and have no commitment to endorse or participate in implementing the resulting design. As well, the Energy Future Coalition, in suggesting that particular technological capabilities or new business practice be tried in a pilot, does not intend to endorse any particular vendor's product or service, but does acknowledge in an appendix those parties who responded to an open solicitation for such pilot project elements. The Energy Future Coalition is grateful for their contributions and assistance with this effort. The appendix offers a matrix of those participants who were willing to be identified, their contact information, and a brief synopsis of the ideas or proposals they brought to the process. Actually conducting any such multi-faceted pilot project as the one laid out in this document would take much collaboration with experts and specialists in technologies and utility affairs, and Maryland could do well to start with those who participated in this brief pilot project design process. A second appendix to this report presents the notes taken during a day-long discussion among some of these participants that can evidence the range of views and ideas expressed and considered, and the presentations by the Maryland utilities to that meeting, additional evidence that those highlighted in this document are selected from among many others that might be equally valid and valuable.

The Nature and Goals of the Pilot Project

A pilot project is an experiment carried out in a real-world setting with a willing electric utility, its willing customers, and other stakeholders and third parties, all adopting, presumably within a defined area of the utility's territory, new technologies, practices, and even incentives and rewards in an effort to identify changed roles, behaviors, and results that offer a better outcome than the current model. In this instance, the pilot projects offered in this document are multi-faceted tests of technological, behavioral, and economic factors that may change the utility service available to and expected by customers in Maryland. The object of the pilot project is to determine how these elements each work out in practice in peoples' homes, businesses, and in the day-to-day operations and finances of the utilities, both by themselves and in combination, so that future decisions to implement them widely can be based on that experience rather than merely on assumptions and hopes.

Although the results of such an experiment would obviously be more telling if all customers in the subject area were required to participate, the Energy Future Coalition assumes that such a pilot project must have volunteer participants, and that those participants may require protection against net losses from their participation. Participation would likely be higher if the default status for a customer is participation, with an option not to do so, the so-called “opt-out” decision. But the typically passive role that customers play in their electric utility relationship may dictate that an “opt-in” structure is required to avoid customers becoming upset who demonstrate no interest or ability to benefit from the options they are offered as part of the pilot. Thus part of the design is to include incentives or enticements for customer participation in the pilot that might not be provided if the pilot elements were found to warrant application throughout the utility service area.

Progress Already Under Way

Maryland is already a leading state in embracing the changes coming to the electric sector. Pepco and BGE have a number of significant modernization efforts already under way, both on a service-area-wide basis and on a pilot basis. The innovations Pepco and BGE are implementing were detailed in their presentations to the day-long round-table discussion the Energy Future Coalition hosted to consider this pilot design; those presentations are reproduced in the appendix providing the notes of that meeting at the end of this document. Both utilities have installed smart meters for most customers, a critical step for smart grid implementation. Both utilities are actively exploring or implementing numerous innovations, so some overlap in direction or effect between the suggestions here and steps already being taken is probably inevitable. This design is intended to go beyond current trials and should not be taken as a criticism of the utilities’ existing efforts.

The Maryland Public Service Commission ordered (in Case No. 9298 on February 27, 2013), while this report was being drafted, that its utilities respond to an investigation with detailed reports related to preparedness for the derecho and the steps taken during and since the storm to improve service. The Public Service Commission staff is evaluating performance-based ratemaking options simultaneously. These pending proceedings obviously constrain the utilities’ involvement in this project, as they should not prejudge their efforts or options in responding to such investigations. The same Task Force report that recommended to the Governor that he charge the Energy Future Coalition with designing this broad-scope pilot included a number of its own detailed recommendations focused on reliability and resiliency; the reliability-focused elements proposed here are not intended to supplant or compete with those of the Task Force. In addition, Maryland’s regulators and legislature have already adopted significant policies that pull or push the electric utility sector in some of the directions in which this pilot design proposes further movement. The suggestion herein that a pilot project element would enhance signals to customers that would lead to efficiency or economy does not mean that there are no such signals already at work in Maryland. Examples include the EmPOWER Maryland program setting standards for future energy efficiency that Maryland’s utilities are obligated to achieve. In this pilot, the Energy Future Coalition suggests numerous steps that would potentially enhance efficiency, and suggests that the credit for such efficiency be counted against those utility goals, without acknowledging that current actions may already achieve some of the same efficiency potential.

Nationally, the Department of Energy has funded a number of demonstration projects for smart-grid capabilities throughout the nation under the American Recovery and Reinvestment Act of 2009, both the “shovel-ready” Smart Grid Investment grants and the “game-changing” Smart Grid Demonstration grants. These projects are just now beginning to report their results and should provide a wealth of additional experience for Maryland and its utilities – which themselves received federal grants – to review in planning. Significant multi-faceted pilot projects are under way, sponsored by National Grid in Worcester, Massachusetts, and by municipal utilities in other cities such as Sacramento and Austin, that will offer lessons about integrating a large number of elements for testing simultaneously. The recommendations here are therefore intended to underline the multi-faceted and interwoven trends and developments that must be taken into account in thinking through the future of Maryland's utility operations, and to encourage a similarly complex trial of potential avenues of response.

Principles for a Better Utility Future

Such a pilot needs to be premised, however, on a vision of what "a better outcome" means and on a perception of the key variables: those that are inevitably changing, those which could change if desired or required, and those which should stay unchanged.

The Energy Future Coalition's vision of the future toward which a pilot project should lead includes a number of judgments and factual predicates that are listed below. These are divided into **six general categories**, for each of which the Energy Future Coalition has recommended elements in the pilot projects that seem likely to move toward achieving the "better outcome" the future will hopefully bring. While it would be possible to select merely one or two elements from the entire list to test, the Energy Future Coalition considers that it is the interaction of many changes in all the categories of utility-customer interrelations that will define the future, and recommends that a multi-element pilot project design be implemented, if not the one outlined herein.

Reliability and resiliency

Reliable service - Electricity service should be available to all customers with excellent reliability and prompt renewal of service in the event of outages, which should be rare and short, including a significant improvement from recent experience in Maryland.

- **Power quality -** Electricity power quality (in frequency and consistency) should be maintained by the local utility at a very high level, meeting the standards of the most demanding electronics and equipment.
- **Utilization of spare capacity and maximization of efficiencies -** Better utilization of spare capacity on the grid and the maximization of efficiencies in utility system operations should be a principle source of savings, allowing the deferral of some new investments and wider allocation of costs of existing investments, and reducing short-term peak period costs.
- **Defined responsibilities -** Utilities in Maryland will not have responsibity for procuring energy for customers other than for voltage maintenance, short-term load following, and for customers who fail to make arrangements for their own energy supply as the "provider of last resort."

Residential Customer Optionality

- **Smart technology -** Residential customers will, over time, seek to avail themselves of the latest “smart” equipment to optimize and minimize their use of electricity, and will make appropriate judgments on using those characteristics to achieve greater savings and convenience. Among the classes of advanced equipment customers will seek to connect are:
    - Whole home control systems that can monitor, communicate with, and control other equipment in the home and sense home conditions, with programming capability to vary performance over time as a function of the cost of electricity or other factors, and with the ability to be remotely monitored and operated, potentially by the utility as well as the home occupant or owner.
    - Smart appliances that are inherently efficient but also capable of communicating with a building control system to optimize their usage and cost.
    - Major power-consuming devices such as water heaters, swimming pool pumps, air-conditioning compressors, heat pumps, clothes dryers, refrigerators, and others that could be cycled off directly or remotely to meet peak load pricing or voltage stability.
    - Electric vehicles that will require significant charging periods and benefit from charging at low-cost hours, and may warrant utility constraints against charging at peak hours.
    - Electricity storage devices that may become commercial to maintain low levels of outage service.
- **Distributed generation -** Customers will be able to install and interconnect distributed generation equipment including solar panels or other renewable and stand-by generation on their premises, or contract with a third party to do so, and will be able to sell any excess electricity through the utility into energy markets, observing all grid safety measures.
- **Pricing response -** Customers will be able to consume electricity on a basis that exposes them to its varying costs over time as a function of energy costs and competing demands, with the potential for cost savings by timing their own usage to low-cost periods through demand response or self-generation or perhaps storage of power.
- **Information flow -** Customers will have access to an ongoing stream of time-sensitive information or direct digital connections that will permit the direct or programmed operation of their “smart” equipment, therefore allowing them to optimize their service and costs.
- **Knowledge of outcomes -** Residential customers will be strongly affected by knowledge of what their probable gains would be from various measures as well as by comparison with the options elected by their peers.

Larger Customer Optionality

- **Islanding ability -** Certain larger customers with large loads, groups of buildings, and perhaps larger groups of smaller customers as neighborhoods, subdivisions, or small communities, will seek to develop larger self-generation capable of meeting some level of their own power demands on an islanded basis when the main grid supplies are interrupted, but use the utility’s distribution system capacity, constituting a micro-grid for purposes of reliability and resiliency, a “back-stop power microgrid.”
- **Smart technology economic advantages –** Larger customers and groups of customers will seek to go beyond potential reliability gains to obtain the potential economic benefits of integrating

their own distributed generation, renewable generation, battery or flywheel storage, and demand response capability, perhaps collectively in a "full-service microgrid" that could island itself for economic benefit as well as reliability, implying customer responsibility for capital investments but potentially warranting separate cost-of-service analysis and obligations.
- **Electric vehicle infrastructure -** Customers with large parking lots or parking structures may wish to provide electric vehicle charging infrastructure.

Utility System Upgrades

- **Distribution grid -** Utilities will continue to own, maintain, and operate the distribution grid of wires, substations, and other equipment required for central service on a monopoly franchise basis. However, the utility power delivery system will need to be modified by combining and configuring smart grid technologies and infrastructure within an open, standards-based architecture in order to support integration of distributed resources and microgrid operations, as well as integration with overall power system operation.
- **Grid maintenance -** Utilities will maintain the responsibility to maintain grid voltage and frequency for all customers on the grid.
- **Reliability investments -** Utilities will make necessary and appropriate investments in their systems, with regulatory approval, to improve reliability, resiliency and cyber security.
- **Smart Grid Potential** - Smart grid technologies have the potential to enable all electric resources, including demand-side and distributed energy resources, to contribute to an efficient, affordable, reliable and sustainable electricity network. By enabling real-time, two-way flow of power and digital information from "source to sink," smart grid technologies can extend the boundaries of utility capacity investments through the meter.
- **Communications investments** - Utilities will make investments to enable them to communicate with customers' devices and to receive and manage vast amounts of data from theirs and their customers' devices.

Utility Business Model Changes

- **Adequate returns -** Making these investments will require that utilities be able to attract equity capital and earn a reasonable return on the equity invested, as well as obtain and service debt at relatively low commercial rates of interest.
- **Downstream shift -** The opportunities for utility investments will shift toward downstream elements of service, including on the customer's side of the electric meter, and will shift from upstream transmission and central generation investments, motivating utilities to seek new earning potential in atypical investments, performance-based earnings, and new standards and business practices to retain their profitability and access to capital.
- **Shared investments -** Utilities will not be barred from consensual arrangements with customers whereby utilities make investments on the customer side of the revenue meter for mutual benefit, either recovering the costs of those investments from the individual customer or, after obtaining regulatory permission, including those investments in the rate base for which the costs are recovered from all customers. This will, however, raise difficult issues of

ensuring that third-party entrants can compete without being disadvantaged by the utility's monopoly position as system operator and preexisting direct customer relationships.

- **Transparent competition -** Electricity supply will continue to be offered competitively by multiple suppliers dealing directly with customers in a "decoupled" market, but utilities should be able to serve in the role of honest brokers making customers aware of competing supply opportunities and their impacts on customer bills and exposures, and by adopting the standards (ideally national standards) all competitors must meet to operate on the system.
- **Third-party offerings -** Third-party businesses will be permitted to offer products and services to Maryland customers in contestable markets, i.e., those other than the natural-monopoly services of distribution wires service and ancillary services such as power quality maintenance, for which third parties may offer services directly to the utility.
- **Re-thinking outcomes -** Maintaining the size and scale of utility operations and entities as major corporate participants in the energy sector could preserve shareholder equity and financial stability in the sector, but should not itself be a driver of market operations or regulatory policy if a better outcome is available from technology and operational practices that do not require such size and scale of utility operations. Smart grid technologies may give rise to new local energy networks or microgrids nested with each other and with the bulk supply system that can achieve better management of overall energy requirements, increasing energy availability across a larger variety of energy sources, and supporting efficiency, economic opportunities, and reliability at the local level.
- **Utility reinvention -** Utilities should nonetheless be permitted every opportunity to "reinvent" themselves and identify new revenue-producing lines of business, consistent with protection of consumers and competition from abuse of their monopoly privileges.

Regulatory Model Adjustments

- **Rewarding performance -** The current trend should continue to modify regulation toward rewarding utilities for good performance in their key monopoly and societal roles and deemphasizing volume of sales or usage as a principal criterion for compensation. Reliability, power quality, and cyber-security are currently undervalued and under-compensated in utility rates; utility financial incentives to promote customer optionality should be adopted.
- **Breaking free of precedent -** Regulators will not be barred by law or precedent from considering new constructs that set different standards for utility payment and compensation in areas conducting pilot projects.
- **Pilot differentiation -** Regulators can differentiate controls and rates that apply to customers opting to participate in pilot projects relative to others that do not opt to do so, even within the same area.
- **New performance criteria -** For ratemaking purposes, regulators will look for and adopt utility performance criteria that are measureable and demonstrable with clear metrics. Regulators should adopt schedules for the value of ancillary services provided to utilities by customers for compensation, thus encouraging investment in customers' ability to provide such services.
- **New Robust Power Markets** – New approaches for connecting retail customers with wholesale market signals will be required, along with new power market rules and products for demand-

side and distributed energy resources, including market requirements and products for the aggregation of smaller commercial and residential market participation.

Structure of the Pilot Design

Within each of these six general categories the proposed pilot design involves the selection of one or more pilot project elements that appear to be (1) commercially available and ready to apply and test in the service areas of Pepco and BGE, (2) as yet untested or unproven in Maryland, (3) likely to generate customer interest and willingness to be involved in the pilot, (4) likely to fit well with the other elements selected in the same and other categories, and (5) likely to generate meaningful results that are measureable by clear criteria and are consistent with the "better outcome" principles outlined above.

Table 1 presents a summary of the Energy Future Coalition's proposed elements for a pilot project design in Maryland, divided among the six categories of areas for future change noted above, with a brief description and notation of the roles to be played and cost allocation that seems appropriate for each. The categories and individual elements are numbered for easy reference to later discussion in the text of this proposal. There is also an indication for each element of the design as to which participants in the pilot design outreach conducted by the Energy Future Coalition (designated by number from the appendix of participants) made a contribution that bore some relationship to that particular element, in the event that the utility of Maryland officials wanted further input on these ideas.

The analysis performed and comments submitted in preparation of this pilot design have suggested that there are five performance factors that should be reviewed in judging the adequacy of an electric utility's service: cost, reliability, customer service, smart grid implementation, and alternate energy support. These are presented in Table 2, together with a description of the utility's responsibilities that would drive its score on that performance factor, and a suggestion of the metrics that could be assessed to measure and quantify that performance to allow it to drive utility compensation. In addition, the elements proposed in Table 1 for the pilot project design include a suggestion of which performance factors would be implicated in determining how well a utility carried out that measure, in order of greatest relevance to that measure.

The remainder of this pilot project report provides additional discussion of the five key elements the Energy Future Coalition has included in this pilot project design, with further elaboration of the reasons for and parameters of those elements the Energy Future Coalition judges worthy of inclusion in each category. Taken together, these elements compose an integrated multi-element pilot project that could be implemented in the service areas of Maryland's principal utilities.

	TABLE 1 ***CATEGORIES*** PILOT PROJECT ELEMENT DESCRIPTION	COST, COST RECOVERY, IMPLICATIONS FOR UTILITY BUSINESS MODEL AND REGULATION	PERFORMANCE FACTORS (IN ORDER OF IMPACT)	PARTICI-PANTS
1	***Reliability and Resiliency***			
1.1	Convert to maximum looped distribution feeder system with automatic sectionalizing and reclosing.	Accept BGE proposal to pilot further work along this line, Pepco to study maximum application and costs in pilot area. Add to general rate base.	Reliability, cost, smart grid.	8, 13, 18, 20, 24, 28, 30, 36, 45, 49
1.2	Establish “back-stop power microgrids” with power sources on portions of utility system, to enable islanded operation of critical uses under emergency conditions.	Allocate incremental power engineering costs, common portion of distributed generation costs to customers within microgrid area, subject to rebates if failure during emergency occurs for non-natural causes. Utility obtains renewable, efficiency credits.	Reliability, customer service, smart grid, alternate energy.	8, 13, 17, 18, 20, 24, 28, 29, 30, 36, 40, 45, 48, 49
2	***Residential Customer Optionality***			
2.1	Install remotely readable controls on major devices, critical functions.	Customer pays costs over time on bill, owns controls, receives rate rebates for use in voltage control, load management, obtains usage efficiency, continued critical service during emergencies. Allow market participation opportunities/aggregation to create revenue streams for customers that invest in new technologies creating these benefits. Utility obtains efficiency credits if any.	Smart grid, customer service, cost, reliability.	1, 3, 6, 8, 9, 11, 14, 15, 18, 21, 28, 36, 37, 39, 43
2.2	Adopt communication technology to allow utility signals to devices and provide energy usage information, including energy prices from customer’s selected provider.	Customer pays on bill for communication to/from devices, costs of utility communication technology put in rate base, energy provider pays costs to provide signals to utility	Smart grid, customer service, cost, reliability.	1, 3, 6, 9, 11, 14, 15, 18, 21, 32, 37, 39, 43
2.3	Identify Green Button-compatible programmable home control systems, provide for and install in homes of willing customers.	Customer pays on-bill for control module, utility installs and programs module per customer instructions, trains customer to use Green Button data and program adjustments.	Smart grid, customer service, cost, reliability.	11, 18, 21
2.4	Adopt program for customers to allow utility remote operation for optimum efficiency, lowest cost per customer instructions, voltage and load control per agreement with customer compensation.	Costs/savings from utility remote operation allocated to general rate base. Utility obtains efficiency credits if any.	Smart grid, customer service, cost, reliability.	3, 6, 15, 18, 20, 21, 37, 43

	TABLE 1 (Cont'd) ***CATEGORIES*** PILOT PROJECT ELEMENT DESCRIPTION	COST, COST RECOVERY, IMPLICATIONS FOR UTILITY BUSINESS MODEL AND REGULATION	PERFORMANCE FACTORS	PARTICI-PANTS
2.5	Adopt electric vehicle program with utility-paid first-cost and energy incentives to EV purchasers willing to offer voltage regulation, variable renewable energy supply control.	Customer buys vehicle, obtains utility purchase cost contribution/ incentive power cost with agreement to allow timed vehicle charging . Utility uses for voltage regulation, variable supply control for renewable energy, system protection. Net cost goes to rate base.	Customer service, smart grid, reliability, alternate energy.	15, 18, 20, 24, 34, 45, 53, 54
2.6	Establish "full-service microgrids" in areas of willing customers with distributed energy resources, storage capability, renewable energy generation, demand response capability, and smart-grid communications and interoperability with utility.	Allocate incremental power engineering costs, common portion of distributed generation costs to customers within microgrid area, but review changes in reliance on system for potential changes in demand charges assigned to microgrid customers.	Smart grid, cost, reliability, customer service, alternate energy.	17, 18, 29, 45
3	***Larger Customer Optionality***			
3.1	Install remotely readable controls on major devices, critical functions, central control systems.	Customer installs, operates, individual application and central control systems, pays all costs, must meet utility standards, may opt to join utility-operated system protection for payment.	Smart grid, customer service, reliability.	1, 3, 6, 8, 11, 18, 21, 28, 31, 32, 36, 37, 39, 43, 48, 49
3.2	Adopt flywheel storage program for large buildings and campuses with solar arrays.	Solar array owner(s), utility (rate base) split cost of flywheel storage to mitigate short-term solar variability, improve power quality, utility obtains renewable energy credits.	Alternate energy, reliability, smart grid, customer service.	4, 18, 20, 36, 38, 45, 48, 49
3.3	Adopt incentive program for EV charging in parking buildings, lots.	Owners install EV chargers (level 1 or 2) in lots or garages at own cost, utility provides interconnections, controls charging, dispatches power as available (including renewable surges) at incentive rate.	Reliability, clean energy, customer service, smart grid.	15, 18, 20, 24, 34, 45, 49, 53, 54
3.4	Develop "back-stop power microgrid" capability in commercial office areas.	Allocate incremental power engineering costs, common portion of distributed generation costs to customers within microgrid area, subject to rebates if failure during emergency occurs through utility fault.	Reliability, customer service, smart grid, alternate energy.	8, 13, 18, 20, 24, 28, 30, 36, 45, 48, 49
3.5	Establish "full-service microgrids" in areas of willing customers with distributed energy resources, storage capability, renewable energy generation, demand response capability, and smart-grid communications and interoperability with utility.	Allocate incremental power engineering costs, common portion of distributed generation costs to customers within microgrid area, but review for changes in appropriate system cost responsibility in light of microgrid investments and capability.	Smart grid, cost, reliability, customer service, alternate energy.	17, 18, 29, 45

	TABLE 1 (Cont'd) *CATEGORIES* PILOT PROJECT ELEMENT DESCRIPTION	COST, COST RECOVERY, IMPLICATIONS FOR UTILITY BUSINESS MODEL AND REGULATION	PERFORMANCE FACTORS	PARTICI-PANTS
4	***Utility System Upgrades***			
4.1	Install devices to continuously align voltage with load, including pole-mounted equipment, fly-wheel storage devices at substations.	Utility installs, rate bases devices to monitor, moderate voltage and load variations, dispatch storage as needed.	Reliability, smart grid, customer service.	4, 9, 20, 38, 45, 49
4.2	Install capability to communicate real-time prices, control signals, use data, directly to willing customers' devices, systems, including back-office capability to manage data flows and monitor system and prices on real-time basis.	Utility installs, rate bases central systems, software, remote devices, communication capability.	Smart grid, reliability, customer service, alternate energy.	1, 3, 6, 9, 15, 21, 31, 32, 36, 37, 39, 43, 48
4.3	Maximize looped system configuration, install automated sectionalization and reclosure.	Utility installs and puts costs in rate base.	Reliability, smart grid, cost of service.	8, 13, 15, 20, 28, 36
4.4	Align sectionalization and reclosure installations with potential and proposed microgrids, islanding and signaling activation under outage or cyber-attack conditions, and supporting microgrid customers' ability to capture economic opportunities and support system.	Utility coordinates with microgrid and potential microgrid occupants, installs and rate bases any incremental sectionalizing and reclosing equipment necessary; microgrid occupants share common portion of segregated operations and energy sources through on-bill financing; are compensated for services offered.	Reliability, customer service, smart grid, alternate energy.	13, 20, 45
5	***Utility Business Model Changes***			
5.1	Convert to performance criteria compensation, with two percent band on ROR on equity for superior/inferior performance.	Utility entitled to recover debt and interest on rate-base, return on equity with enhancements for superior service and deductions for inferior service.	Cost, reliability, customer service, alternate energy, smart grid.	12, 18, 20, 35, 50, 55
5.2	Expand customer-service operations and personnel, including appliance and central control system installers, trainers, troubleshooters, distributed generation interconnectors, microgrid facilitators, assigning named customer relations staff to specific areas, specific large customers.	Utility develops professional customer service and system operation corps of employees. Customers sense a new, interactive relationship with utilities, including personal relationships, and that utility is working to meet specific customer needs and provide desired options.	Smart grid, customer service, alternate energy.	1, 3, 6, 18, 20, 21, 33, 35, 37, 39, 43, 55
5.3	Utility becomes active collaborator with microgrid participants to manage overall energy supply, quality, control and reliability at local level.	Utility facilitates microgrids as part of its system, with customers responsible for microgrid energy sources, incremental costs required for outage operations.	Reliability, customer service, alternate energy, smart grid.	1, 8, 13, 18, 20, 28, 30, 36, 40, 45, 48, 49, 55

	TABLE 1 (Cont'd) *CATEGORIES* PILOT PROJECT ELEMENT DESCRIPTION	COST, COST RECOVERY, IMPLICATIONS FOR UTILITY BUSINESS MODEL AND REGULATION	PERFORMANCE FACTORS	PARTICI-PANTS
5.4	Utility obtains and offers customer investment capital to finance customer equipment for system integration and control benefits, efficiency and energy cost savings, to be recovered on utility bills. Utility records loans in real-estate property register and makes any loan, costs, and financing arrangement information available to authorized buyer, with before and after utility bill information.	Utility becomes significant source of financing for customer system controls and optionality, recovers associated debt and interest through on-bill financing, secured by ability to assign debt on permanent installations to next owner of building. Real estate transactions involving energy efficiency improvements financed through utilities are transparent to prospective buyers, efficiency is valued in sales.	Smart grid, cost, reliability, customer service, alternate energy.	3, 18, 20, 22, 30, 35, 38, 40, 43, 48, 49
6	***Regulatory Model Adjustments***			
6.1	Convert to performance criteria compensation, with two percent band on ROR on equity for superior/inferior performance.	Utility has clear performance guidelines which directly affect return to shareholders, but is not threatened in recovery of system operating costs and investments.	Cost, reliability, customer service, alternate energy, smart grid.	12, 18, 33, 50
6.2	Customers **themselves** elect weights to accord to utility performance factors, pay actual rates individually differentiated by performance as determined through selected factors. Customers may modify weightings on-line as often as once per year. Weightings subject to PSC-set minimums.	Utility's customers will pay utility for what they value most in utility's services. Utility will have perfect knowledge, by geography, customer class, and size, down to individual customers, of the expectations they are expected to meet, and can differentiate their investments and efforts to meet them.	Cost, reliability, customer service, alternate energy, smart grid.	12, 18, 33, 50
6.3	Set baseline system management cost of service (separate from system equipment costs, customer service costs), allow utility to retain 1/3 of savings below baseline from reductions attributed to integrating customer equipment for two years.	Utility has incentive to minimize overall costs of service while meeting other performance criteria. Customers' rates decline by 2/3 of savings for two years, but motivate greater, faster reductions in the end.	Smart grid, cost, customer service.	12, 18, 33, 50
6.4	Permit utility to make validated customer-side investments geared toward smart grid, energy efficiency at customer's cost, with on-bill repayment that survives real estate transaction, obtaining credit for savings.	Puts utilities in position of offering low-cost, long-term financing for customer-side energy efficiency, recovering costs, debt and interest on pass-through basis on utility bills, helps utility meet Empower Maryland obligations, which could then increase.	Cost, smart grid, customer service.	2, 4, 8, 13, 18, 22, 28, 30, 35, 36, 38, 49
6.5	Permit utility on-bill repayment of customer-side utility investments, conveying obligation to new owners of premises with permanent investments.	Allows utilities to ensure that customers have capital to make appropriate system control investments, recovering costs over time through utility bills.	Cost, customer service, alternate energy.	2, 18, 22, 24, 30, 35, 38, 40, 49

	TABLE 1 (Cont'd) ***CATEGORIES*** PILOT PROJECT ELEMENT DESCRIPTION	COST, COST RECOVERY, IMPLICATIONS FOR UTILITY BUSINESS MODEL AND REGULATION	PERFORMANCE FACTORS (IN ORDER OF IMPACT)	PARTICI-PANTS
6.6	Permit utility to rate-base customer-side investments that contribute to system management, reliability, recovering them from all customers, including part of microgrid segregation and signaling costs.	Allows utilities to recover from all customers investments that directly improve overall system operations, including proportion of costs attributable to system improvements where there are also customer-only gains.	Cost, reliability, customer service, alternate energy, smart grid.	13, 18, 20, 30, 35, 38, 40, 49
6.7	Where customer-side investments serve both system operation and energy efficiency purposes, allocate costs between rate-base and customers.	Utilities and customers should agree in advance on the respective value of customer-side investment to customer and to utility system management.	Cost, reliability, customer service, alternate energy.	18, 20, 22, 31, 35, 40
6.8	Adopt value schedules that govern utility payments to service providers for voltage regulation and other ancillary services, coordination with ISO/RTO in organized power markets.	Utilities should pay for ancillary services in predictable scheduled amounts that allow providers to plan investments and operations to the extent possible.	Smart grid, cost, reliability, alternate energy.	4, 9, 18, 20, 38, 40, 45

Table 2. FIVE PERFORMANCE FACTORS

FACTORS	DESCRIPTION	METRICS
Cost	Utility's responsibilities to: • minimize costs, capital investments, • improve cost effectiveness of operations and maintenance, increase asset utilization, • meet regulatory standards and public policies, • optimize energy use by system itself, including utility vehicles and buildings, • reduce line losses, and • replace inefficient equipment.	Cost of service per customer, per unit of electricity delivered, relative to other utilities in Maryland, nation, normalized for weather, per capita income, GDP, inflation, other factors.
Reliability	Utility's responsibilities to : • provide continuous service, freedom from outages, anomalies, critical needs, shed unnecessary load. • restore service promptly after outages. • Upgrade system capability to isolate, minimize, and shorten outages. • maintain system voltage, frequency, and other measures of power quality. • defend system controls, monitors, and data from cyber intrusion and disruption, including customer-operated systems.	Number and duration of outages, by region, neighborhood, customer, including momentary blips. Speed of recovery from outages, number and accuracy of outage status reports. Voltage and frequency constancy, anomalies, surges. Cyber-related penetrations with damage or delay, detections of malware, viruses, or worms.
Customer Service	Utility's responsibilities to: • relate productively to all customers, • respond quickly and effectively to customer concerns and opportunities, • provide full, timely, and appropriate information, especially during outages, • assist customers to achieve energy efficiency.	Customer service calls answered, wait time, customer satisfaction surveys, efficiency gains relative to base period by customer by class, by building per square foot, normalized for degree days, economic activity.
Smart Grid Adoption	Utility's responsibilities to: • Select, install, and operate integrated suite of digital equipment on its system to provide information, control, monitoring, billing, and integration with customer applications. • Select integrated suite of matching equipment for customers, install and demonstrate. • Train and support customer use and benefits.	Extent of system digitally monitored, controlled, automated for contingencies, amount of data managed, number of customers opting smart grid installations, remote appliance operation by utility, customer complaints about smart-grid capability, equipment.
Alternative Energy Support	Utility's responsibilities to: • integrate renewable and other distributed energy generation into system operations, dealing effectively with intermittency, • provide quick and reasonable interconnections, • support development of microgrids, • promote workably competitive markets for energy, capacity, efficiency, and any services other than utility's own monopoly services .	Wait time for clean energy interconnection, integration, curtailments from over/under voltage, surveys of clean energy system owners, suppliers, market participants, customers, vendors, costs of competitive offerings relative to other utility areas.

Major Tasks of the Pilot Design

1. Piloting Customer-Driven Performance-Based Utility Compensation

Perhaps the most important innovation the Energy Future Coalition recommends in this pilot project design is a novel means of changing how electric utilities get paid to align their rewards with the actual current needs of their customers.

The current structure of electric utility business practices, with its costs and returns set as a function of anticipated deliveries of power under a regulatory formula that recovers approved capital investment and offers profits that increase upon exceeding the projection, is a vestige of the creation of the electricity industry a century ago.

This reward system tied to volume of power sales is no longer appropriate. Although electricity demand growth has already flattened dramatically from that experienced in earlier decades, there are major opportunities for major further efficiency in lighting; appliances; heating, ventilation, and air conditioning (HVAC); and improved building construction and insulation, as well as in commercial and industrial uses. The volume of electricity sold could therefore fall in absolute terms under credible future scenarios.

At the same time, these continuing uses and many new applications for electricity, such as digital electronics, computing, wireless communications, and microwave cooking, require higher degrees of electricity service reliability, consistency in power quality, and avoidance of interruptions. Our modern economy continues to electrify, computerize, and connect us through electronic communications devices. And a major new potential use of electricity is on the horizon – vehicular transportation.

Thus economic growth and modernization carries with it an inevitable expansion of electricity services, at the same time that the absolute quantity of electricity generated and sold appears to be either flat or declining. Without dependable electricity supply, few aspects of modern life could continue. But the business of providing that critical commodity through ever-more reliable and consistent service cannot be adequately financed and compensated if the revenues are tied to diminishing volumes of electricity generated, transmitted, and distributed.

The absolute value of electricity service is difficult to measure, and thus difficult to express in rates. As with other essentials, one cannot truly appreciate the full range of their necessity until one is without them. One can only fully appreciate the irreplaceable role of electric service in modern life during an extended outage.

Residential outages impose massive inconvenience, interruption of productive home businesses, and true risk to life and property under some circumstances. But the economic value of residential outages is hard to weigh against the costs of measures that might make such outages rarer and shorter, in part because activities at home are not priced or measured with any accuracy. The cost of commercial and industrial outages, by contrast, is relatively easy to calculate against the value of operations under full power, and amounts to many billions of dollars per year across the nation. The Governor's task force report indicated that for every dollar in measurable value of a day-long residential outage, there was potentially $8,000 in measureable value from a similar outage for a large commercial and industrial customer. Since the value of residential outages from the derecho for Maryland was estimated by the Governor's task force at $593 million dollars, one could hypothesize that the value of commercial and industrial outages of the same length, despite a much smaller number of customers, could easily have amounted to billions of dollars. Such a dramatic cost could clearly justify significant investments to prevent outages.

Until recent years, electric utility customers have been passive, even compared to consumers of other energy forms, accepting and paying a lump-sum bill based on whatever the meter showed had been their full use in the prior month without any sense that they had market or electricity price options, and in tolerating interruptions. They might know their total bill, but most have no idea what they paid on a per-kilowatt hour basis. Many customers are still content to pay a historic flat rate as established by regulators, as long as it does not rise quickly, and take their service for granted. But as the value of power and the cost of outages have increased, other customers have become more actively concerned and many have begun to consider options leading to greater self-sufficiency such as installing back-up generators or advocating for undergrounding of lines. The increased value, along with the improved technologies to allow response to it, has also attracted entrepreneurial innovators to offer products and services to customers that could lead them away from utility services, or to bring new resources and means of participation in the utility services they use.

It has become clear that utility customers are obtaining attributes of service other than the volume of electricity they consume in kilowatt hours, and that any true valuation of electricity service – and by extension, any appropriate regulated pricing of electricity service – should take other factors into account. Utilities are likely to be much more responsive with regard to those attributes to the extent they are recognized by customers and regulators, and especially to the extent utilities are rewarded for serving them.

The question in designing a pilot utility service for the future is how to combine the "better outcome" that is sought with a scheme for compensating the utility that is linked to the separate efforts the utility is asked to make to achieve that "better outcome." The answer embraced by the Energy Future Coalition for this pilot project design is to refocus utility compensation directly on the attributes customers seek in the utility's performance, and vary that compensation as the utility's performance varies as gauged by those factors. This is not a novel approach *per se*, as there are performance-based ratemaking approaches in use in various jurisdictions, and the Maryland Public Service Commission staff is already pursuing performance-related attributes for utility ratemaking related to reliability and resilience. The Energy Future Coalition proposes in Table 2 above a set of performance factors against which the utility's service can be judged, with specific metrics that could be examined to measure the utility's performance on each of the elements piloting the future utility service.

The obvious next question is how these five performance factors, assuming they encompass the right set of responsibilities to expect utilities to embrace, should affect a utility's compensation, relative to each other and to other revenue requirements. The Energy Future Coalition, after discussions with experts on utility compensation and incentives for this project, believes that these factors, taken together, should be used to vary the allowable rate of return on the utility's equity portion of its rate base. The proposal is to create a two percent band (one percent above and below the otherwise applicable rate of return on equity) established in the normal manner as the appropriate reward for satisfactory levels of service. If the utility's performance on these five factors was particularly strong, the utility would be entitled to as much as a full percent increase in its rate of return. If, on the other hand, the utility's performance was unsatisfactory and disappointing relative to these factors, the utility could be penalized by as much a full percentage point from the otherwise applicable rate of return.

The next issue is how to determine the allocation among these five factors to determine the effective weighting that should be applied to adjust the rate of return. The Energy Future Coalition believes that, as a novel approach worth testing, customers themselves should be entrusted to provide the appropriate weighting of these factors. Different factors matter more to some customers than to others. A whole neighborhood that experienced a significant outage might put great emphasis on reliability. Customers with solar roof arrays, combined heat and power, or other distributed resources might particularly prize the utility's performance in integrating clean energy. Other customers might be most focused on a utility's customer service practices, especially in promoting a customer's ability to utilize digital controls and information technologies to optimize usage and cost.

The proposal is that each customer would be offered the opportunity to provide an initial weighting of the five performance factors that customer believes should guide the utility in its investments and efforts. This could be done with a simple ranking of most to least important. It could be done by assigning descriptive terms such as "critical," "very important," "important," "unimportant," or "useless" to each performance factor. It could involve a customer assigning a priority weighting from 1 to 5 or 1 to 10 to each factor, or involve the customer assigning each a percentage weight to each that would be required to add up to 100%. There are a variety of ways that customers could express their views, and one that is relatively straightforward and easy to understand and respond to would be best. The key is that the customers would know that their sense of utility-service priorities would matter, and indeed would count toward the utility's rewards for service well or poorly rendered.

Using any of these options, regulators could then determine a composite quantitative performance objective weighting these five standards, one that could then apply to the utility's prospective performance and determine its success in earning a bonus return or accepting a penalty in the subsequent year, based directly on the customers' own sense of priorities. The average of the customers' percentage allocations among the performance criteria would be applied to performance metrics the utility achieved to determine the overall actual return on equity, and whether the utility earned any increase above the standard rate or suffered any deduction from it. Willing customers could also provide the utility a grade on its performance for each of these factors for the prior year, although the regulator's quantitative determination and not the customers' grades would establish the prospective rate of return weightings.

From the utility's perspective, however, such a compensation adjustment scheme would present the ultimate guidance toward successfully meeting customer expectations. The utility would have perfect information as to how to steer its own efforts to increase its customers' satisfaction and earn a bonus rate of return on equity. Indeed, the utility would have such information with geographic specificity, the ability to understand the differing values of differing classes and neighborhoods of customers, the particular preferences of a major customer, and the ability to tailor its services and investments to meet the particular priorities its customers were expressing, and then to be rewarded for its much more focused work with as much as a full additional percent in its rate of return. To the extent the utility focused its work directly on the identified priorities, the utility would be guided toward the key problems its customers identified, and would have a complete idea of their composition among customers and areas. The number of complaints filed should fall, customer satisfaction should increase, and there should be a significant improvement in the overall system operation matched to what customers wanted, using the fundamental driver of rewarding utility investors for achieving it.

In Table 1, the third column reflects the utility performance indicators that would be affected by the utility's performance in carrying out each element of the proposed pilot project design. Most elements, if successfully implemented, would assist the utility to increase its rating on multiple performance factors.

The proposed innovation of having customer priorities drive the establishment of a weighted index of performance factors applied prospectively to utility rate of return is not the ultimate possibility in revising the business model relationship to customers. As a separate but closely related proposal, the Energy Future Coalition also suggests that the utility rate that each customer would be charged would be established based on that customers' **own individually-set** priorities for the aspects of utility performance that customer valued.

The utility's cost of service would be the basic part of the rate each customer would pay, including recovery of debt and interest and repayment of equity. And the cost of energy – the largest component of the usual customer bill – would be independent of utility compensation and wholly unaffected by the utility's performance factors. The return on equity component would be a relatively modest component of the bill, but it could vary from customer to customer as a function of the utility's performance on the five performance factors as weighted by that customer. The customer would be entitled to modify his or her percentage allocations among the five performance criteria, but not more often than once per year with effect the following year. A major customer with a major load for computerized equipment and servers might, for example, particularly value power quality and constant voltage, and could express that priority in its allocation of performance factor percentages, then pay a rate reflecting a higher return if the power quality was indeed maintained at a high level, and a lower rate if there were numerous dips or surges in voltage to contend with.

This approach should be readily administered with modern back-office bill preparation software. As each customer's bill is generated, the computer would look to the weighting of performance factors selected by that customer in that customer's record, and apply that weighting to the actual performance factor metrics as determined by the Public Service Commission for the immediate prior period, setting a rate-of-return component in the rate to be paid by that customer based on how well the utility served that customer's own sense of performance priorities. Since the utility's actual rate of return adder or deficit would be the composite of all customers experience with these factors, differentiating the utility rate of return charge for a given customer based on his or her own sense of the relative priorities and importance of these factors would disaggregate the customers charges, but would allow composite revenues to equal those set by the proposed composite return.

This proposal would require customers to pay somewhat more who should be most satisfied with a utility's performance, and customers to pay somewhat less if the utility was unwilling or unable to serve their priorities for utility service. As a combination factor affecting only the equity rate-of-return component of the customer's total bill, the difference between similar customer's charges would not be huge, but it would be enough to give a customer a sense that he or she had the power to hold the utility accountable to his or her own needs and criteria for electricity service.

It is certainly true that adopting such a customer-specific variation based on performance might be relatively expensive to implement for a smaller pilot project area than for an entire utility, but the preference setting function could potentially be built into a customer's home management system in a way that the utility could read it, recorded by the customer when logging onto the utility company's site for his or her consumption information, or solicited in writing by a pre-paid return-mail bill-stuffer enclosed with the utility's invoice. The Public Service Commission could establish default values among the performance factors that would apply where customers had not specified their own. If adopting such a prioritization process for all customers within the pilot area appears too expensive or complex, a fall-back option would be to adopt it for customers above a certain size, or to adopt it based on the average of neighborhood surveys among smaller customers, or in other ways to reduce the number of respondents whose preference data would have to be managed.

On balance, however, few changes would be as likely to align utility actions with customer values, requirements and preferences as to adopt such a customer-driven prioritization of performance standards, at the same time providing the detailed information that would allow a utility to meet its customers' expressed preferences with precision. Customers would have the basis for a whole new appreciation of the role and responsiveness of their utility, and utilities would have a regularly updated sense of their customers' needs and priorities. This would truly revolutionize the utility-customer relationship that has characterized the previous decades – often an unhappy one – and create the basis for a forward-looking partnership focused on what customers value most in their electricity service.

This approach would give customers the sense that they were paying for what they themselves valued, and that their concerns and sense of being treated well really mattered to the utility. This in itself would constitute a significant change for the better. Equally important, however, is that such an approach would provide each utility detailed geographic and customer-class information about their customers' expectations and priorities, the perfect input to guide the utility's efforts, so they would have the best possible odds of winning the bonus rate of return, and the ability to monitor their customers' level of satisfaction as they were being served. It would help create a wholly new utility-customer relationship of responsiveness, accountability, and two-way communication that would itself be of value to customers and the utility industry. Utilities would have every reason to help their customers understand what the performance metrics meant, how they were responding to the customer's relative valuation of those standards, and what customers should do to make their own priorities clear. They would effectively be campaigning for their customers' support and agreement, not depending for feedback on customer complaints reaching them through regulators or legislators or newspapers.

Electric utility customers will have an array of new options in the future, including self-generation, possibly storage, and certainly competitive technological innovations. There is a real chance that utilities could play a sharply diminished role in that future unless they identify a new and mutually beneficial business relationship their customers prefer to the alternatives. Even to maintain their present role with expected levels of reliability and service, utilities will be required to make major new investments that, given likely flat load growth, could mean higher rates for customers. Utilities need to begin shaping a new and more positive and interactive customer relationship with a greater sense of accountability and responsiveness, making clear that they are offering higher levels of service to match any rate increases, if they expect to keep their customers' confidence and business over coming decades.

2. Piloting a Programmable Power-Use Environment

A second major goal of the pilot project design proposal is to move aggressively in the pilot project area toward a fully integrated and interoperable system of utility and customer digital information, controls and communications from the central utility and from energy markets to individual customers and to their separate programmed appliances. The proposed pilot(s) could demonstrate that, with communication-connectedness and utility authority to manage and optimize, "grid-responsive" (grid supportive) distributed assets could be developed and utilities could play a major role in realizing the fuller "transactive-energy" potential of smart grid technologies.

The Energy Future Coalition's contacts with stakeholders, technology vendors, and other experts during this process indicate that the technology – hardware, firmware, software, information standards, communications – is available to achieve this goal. Perhaps half of the eighty or so stakeholders responding to the Energy Future Coalitions solicitation for ideas for this project offered technologies or equipment that could play a role in providing this capability if selected. Smart meters have already been installed by Maryland's utilities that should allow utilities to track the real time consumption of electricity not only by individual customers, but by individual devices within that customer's premises if the proper signals and software is adopted. Home management programs and displays are on the shelf that can allow a customer with access to specific time-sensitive price data for power to program his or her devices to respond to signals to operate at the times when it is most cost-effective so that the customer can simply profit from their automated functioning. The Green Button information standard developed by the White House Technology Office and the industry is an excellent standard for providing Maryland's customers in the pilot project area with access to the data they need.

With a customer agreement and the right access through the meter, the utility could be the direct actor, ceasing energy flows to certain uses that are interruptible – refrigerator defrost cycles, swimming pool pumps, storage water heaters, air conditioning compressors, electric vehicle batteries -- without affecting the customer's enjoyment or requiring the customer's hands-on intervention, in order to meet peak loads, deal with voltage variations, accommodate variable renewable energy, or otherwise manage the grid in the most cost-effective and stable manner possible. The leading "white goods" manufacturers are already planning to include inexpensive "smart chips" in every major appliance starting after 2014, but these new capabilities will mostly go unused unless utilities and other devices make their use easy and beneficial. Standards for interoperability are being announced from the process conducted by the National Institute for Standards and Technology and other standard-setting organizations that should insure a common language among utilities, meters, computers, controls, and appliances. Finally, communications capability using such media as unutilized FM Band radio signaling and receivers is available to send real-time price and control signals from central to remote applications securely, instantaneously, without any exposure of customer information. Cloud computing offers a separate set of possibilities for uploading information, applying sophisticated processing to it, and generating individualized instructions to utility equipment and customer equipment on an itemized basis to optimize the grid.

What has been lacking is not the technology, but the knowledge on the parts of most consumers that such technology is there, the understanding of what its benefits could be, the regulatory schedules that would allow customers to see variable energy prices from their suppliers and capture them through their utilities, the investment capital to install and program the various controls, and the incentive for utilities to take on new lines of business in league with their customers with the effect of reducing sales and revenues. These factors have combined to ensure that there have been few if any integrated tests of such technologies installed throughout a given area. That is what this pilot project design proposes be conducted by Maryland's utilities.

All five of the recommended elements of the pilot design proposal within the category of residential customer optionality (2.1-2.5), as well as large customer option element 3.1 and utility system upgrade element 4.2, represent proposals that depend on installing an integrated information and control system that empowers customers themselves. They further provide that the utility, with the customer's permission and to the customer's financial benefit, see, talk to, and control devices remotely in an optimum manner, meeting needs for cost-effectiveness, efficiency, and utility system stability. This also will require the agreement on open, standards-based architecture within which smart grid technologies and infrastructure can be combined and configured as part of distribution systems to support the orderly integration of distributed energy resources into utility distribution system operations, overall power system operations and the market. Such architecture is necessary to achieving "interoperability" and "integration" on a "system-wide" scale to help standardize the use of demand-side and distributed energy resources as part of overall power system operations and control.

As is explained below, the Energy Future Coalition believes that the best approach for a pilot is to ask the utility to take the lead in selecting, installing, and operating these systems rather than opening the opportunity to all comers and letting a wide variety of vendors and operators compete for customers and attempt to deal with the utility's system and standards. With regulatory permission, the utility could also provide a standard channel of communications concerning the costs of energy from the customer's provider and other alternatives in real time, allowing the customer significant savings on energy that would more than offset the customer's cost of the equipment making it all possible.

Maryland and its utility regulators will, however, have to make a difficult choice in instances where utilities are providing customer services beyond the traditional natural-monopoly system operation services, such as the services of enabling small and residential customer buildings and equipment to respond to system signals and real-time energy prices. Regulators can either:

- Authorize the utility to provide such customer-side investments and services under regulated rates and standards; **or**
- bar the utility from providing such services itself, but require it to facilitate competitive third-party businesses and customers who seek to do so, establishing and enforcing the common standards for interoperability, and providing for rate recovery from all customers of the associated costs on the utility's side of the customer meters.

The Energy Future Coalition does not believe that it would be a viable third option to allow the utility to compete to provide the new services with third-party entrants seeking to make a business out of doing so in the residential and small commercial sectors. The utility's preexisting customer relationships and natural monopoly would inevitably provide a marketing and operational advantage that would undermine that competition, unless the effective separation of the utility's unregulated competing entity from the utility's regulated services were so complete that they were effectively separate businesses with no affiliation – i.e., the second option above.

As between these two choices, there are pros and cons of each. The first provides a major new potential business and revenue flow to utilities that could go far to offset the loss of utility cash-flow that otherwise appears likely. It would enable the scale of procuring equipment and installation services that could keep overall costs very low. It would provide great utility incentive to help customers balance and support the system while also saving energy and cost. It would create the basis to integrate distributed generation seamlessly. It would ensure interoperability of utility and customer systems because both are selected, installed, and operated by the utility. And thus it would keep the responsibility squarely on the utility for making sure the system integration and responsiveness works well on both sides of the meter, rather than yielding finger pointing between the utility and third-party providers or customers when that coordination is lacking, presumably in the wake of a crisis. This would combine well with a new compensation formula rewarding the utility for performance, including those aspects of performance that could be improved by better integration of customer equipment and options.

That choice, however, would deny entrepreneurs their opportunities and individual customers the ability to let competitive market dynamics drive costs lower and drive technology preferences and improvements. It would be less likely to foster the growth of a new segment of products and services that could bolster the entire economy and provide the U.S. with its latest world-leading services and technology for export. Utilities are not good innovators, but are highly risk-averse and conservative entities that have the responsibility for reliability and consistency of the operation of critical infrastructure; the trends playing out in the transformation of the electricity industry absolutely call out for the high levels of innovation, risk-taking, and experimentation that a swarm of competing technology vendors and third-party intermediators will inevitably bring. Especially with performance-based reward structures, utilities would err on the side of what is safe and proven, and be unlikely to select and install leading-edge systems and technologies that might promise greater savings and sophistication but also greater risks of performance problems.

No one familiar with the performance of most electric utilities over prior decades would have great confidence that utilities could manage the technology and service transformation coming to the sector without leaving much of the potential benefit uncaptured. On the other hand, no one could have greater confidence that leaving the selection and operation of new customer-side options to a free-market tumult would optimize the overall system operations and economics. And in either event the utility's deep involvement would be required for its own system technology decisions and to set and implement the standards by which the customers' equipment would interface with the utility's.

This choice is essentially the choice laid out by Peter Fox-Penner in his seminal book, *Smart Power*, between the utility as the new integrator of competitive offerings versus the direct provider of end-use services. It might well be that Maryland should adopt pilot project designs that test both of these options. In one pilot project, Maryland could permit and indeed require the utility to be the leading agent of change, modifying the basis of its own service to customers to the point of monitoring and controlling the actual services electricity enables for them, and tie the utility's compensation to its performance and its customers' degree of satisfaction with the result. In the other, Maryland could require the utility to back off to be merely the neutral and passive operator of the central system connections, setting standards but allowing customers and their costs to rise and fall, and their services to be on and off, as a function of their own choices and investments with the vigorous help of the competitive technology and service industry that is already springing up. In that case, utility compensation would be relatively constant but modest as a function of the investments required for the central system to meet its operational standards and respond to the varying requirements of customers. The regulators would establish a regulated rate for those new services that compensates their additional cost, authorizing the utilities to charge that rate either to the specific customers accepting the optional service, or to vary the rate for all customers to "socialize" those costs on the basis that all customers benefit from the new service, or some combination of the two.

If there were to be only a single pilot project, forcing a choice between these alternatives, the Energy Future Coalition would err on the side of piloting the first option, the option that puts the utility's operations and incentives on both sides of the residential and small commercial meter at some loss of competitive savings and innovation. One reason for this choice is that in the event it becomes clear that the other choice was preferable, it would be easier to undo this selection, letting competitive entrants in and spinning off the utility's customer-side investments, than it would be to have the utility take over and operate a host of varied systems and technologies whose lack of synergy or collaborative functionality presumably caused major problems in the first place. In addition, given that there are more than 3200 electric utility entities at the distribution and wholesale level in the U.S., and hundreds of competing technology vendors and service providers already seeking business among them, competitive market drivers should already be able to operate effectively for the sector as a whole without having to operate at the individual retail customer level within each of those utilities, including Maryland's. A third reason for preferring this option is that residential electric service customers have traditionally been very passive, although this is more a result of their prior lack of options and information than any intrinsic inability to act in their own behalf. It may be a bit too much to expect that most of them will be ready to jump into a competitive market for appliance controls, whole-house programs, and a new business relationship with their utilities as a vendor of power and services as well as a purchaser. It is unlikely that many individual residential customers would leap to real-time pricing for the modest savings that are available unless their systems and appliances were programmed to achieve those savings without more than their own initial involvement. It would take utility scale of aggregation for those individually modest contributions to achieve the overall system benefits warranting the investment, a scale hard to achieve by competing providers in a pilot-project sub-area of a utility service territory. Finally, the potential advantages of being able to recover individual customer project costs on the utility bill over time, including conveying the responsibility for investments to successive owners of the same property, could only be effective if the utility made and maintained responsibility for the investments.

It is quite possible that the utility itself might reject the option of making customer-side investments and being responsible for their effectiveness over time. If so, the regulator's choice to allow third-party entry will be obvious.

It should, however, be possible to make different selections for different classes of customers, allowing the utility to be the designated system and technology provider for residential customers, and opening the market to competitive providers for commercial and industrial customers, also allowing aggregations of residential customers in large multi-family buildings or integrated neighborhoods to opt for competitive services. Indeed, large commercial and industrial customers are everything the residential customers are not: fully ready to take charge of updating their own systems, tuned into the potential for savings from doing so, better able than the utility to ensure the compatibility of the systems with the businesses those systems support, and ready to make wise choices among competing equipment providers. Therefore the pilot design suggested here provides for competitive selection and installation of smart-grid capability for larger customers, provided that they meet the standards to interoperate with the utility's own equipment.

The Energy Future Coalition believes that establishing a size threshold for this element of the pilot project design could be determined by the regulator as a function of the comments submitted in the design proceeding; the greater the desire of a class of customers to make their own equipment and digital control vendor decisions, and the greater the commentary from entrepreneurial stakeholders wanting to offer and install their products for such customers, the more inclined the regulators should be to allow them room to do so in a pilot project, among larger customers or aggregations of smaller customers.

It might also be that there would be some division of those technologies and services which are geared to saving or selling energy, already a competitive sector, from those geared toward supporting system operations through voltage support or regulation, which the utility must operate. If so, then third-party entry could be permitted and encouraged for the former, while the utility would be the sole provider of the latter. The Energy Future Coalition has not attempted to make such a division of prospective technology offerings and services, and believes that many could serve both energy efficiency and system management functions.

One part of the pilot project design is thus the proposal that the utility select and install on its own system of a set of integrated digital communication, monitoring, control and metering technologies that would enable improved grid visibility, control, and automation. By itself, this is not new. But the pilot design further proposes that the utility also select and install a matching set of digital technologies for willing customers on those customers' premises to enable the customers to monitor, control, and program their own electricity usage and potentially permit – with the customer's agreement – remote control by the utility, on a device-by-device basis. Customers would not be forbidden to select other technologies or options, but those technologies would be required to meet the utility's specified standards for interoperability with its own system – standards the utility-recommended systems would automatically meet – and the utility would not be responsible for integrating the customer-selected equipment with its own system and services, nor be responsible to the customer for its effectiveness, as it would with any system devices the utility itself selected and installed.

The utility-selected controls for customer's devices would obtain access to real-time price signals and could be programmed by the customer to respond in a manner minimizing cost, but also could respond to the utility itself in a manner allowing the utility to maintain voltage, frequency, and system stability without undermining these devices' utility to the customer, even while the utility simultaneously used the new demand-side flexibility to increase variable energy inputs from renewable and distributed generation and meet other system needs and constraints. Customers who agreed to allow the utility to remotely access their devices for the benefit of the grid would obtain this equipment at a substantial discount and potentially also be compensated during its use, with the costs allocated to all customers benefiting from a more reliable grid.

The ratepayers in general and individual customer should split the investment costs as a function of the relative benefits to the system as a whole or to the individual customer's savings. Making such integrated suites of device-control, information management, and communications technology available to customers, and working with them to use it well, would foster a new service-oriented relationship between the utility and its customers focused on saving the customer money and providing modernization and convenience – not the traditional utility-customer relationship. It would position the utility well to offer other related services, although careful judgments would have to be made about where to rely on competitive third-party offerings versus directed utility services.

As part of this expansion of utility service roles, which would not be significantly different from the in-home service roles provided by cable telecommunication companies and other entities, utilities would be expected to substantially staff-up and improve their customer-service capacity. This could include customer-service representatives assigned to individual areas of the utility service area, pro-actively reaching out to customers through civic groups and community associations, accompanied by print and other media announcements inviting customers to be in contact with the options they would like to embrace as well as problems they need to report. Utilities also could work in partnership with local governments to increase awareness and engage customers. Technical support specialists for the utility could support customers in programming and benefiting from their home-energy systems and individual devices to maximize their economic benefits. Utility bills could display a comparison of the current bill with upgraded devices and controls with the bill that would have been likely under the same weather conditions without such investment, as well as information about what neighbors were doing to lower their bills or improve their service even more. Also, in partnership with local governments, utilities might explore “community-scale” investment options, especially for multi-family homes, apartment/condo complexes, industrial and business parks, etc.

3. On-Bill Utility Financing of Customer Smart-Grid and Efficiency Measures

Utilities’ upstream investment opportunities in generation and transmission capacity are shrinking as a function of decoupling, unbundling, and increasing energy efficiency among major electricity use applications. For utilities to remain financially healthy and able to attract low-cost capital, the pilot project therefore proposes opportunities for them to make capital investments on the customer’s side of the revenue meter where system benefits are available, such as voltage regulation and load control to meet peaks more economically.

In addition, the pilot proposal would allow utilities to finance customer investments in smart-grid control systems, smart devices, and validated energy efficiency measures, with customer repayments to the utility through their monthly utility bills. On-bill repayments for permanently installed efficiency and system control devices would be tied to the premises, not the individual customer, so that the obligation would convey with a sale to any new owner. This would address the “spit incentive” dilemma and allow owners uncertain of remaining in a property over the long-term to make long-term investments in efficiency and smart grid options that would increase the value of the property. Utilities would be obligated to record such loans against the property to alert any potential buyers of their presence, and to share before and after energy consumption information about the property with those buyers who had the seller’s permission to obtain it.

The utility would earn its costs of making the financing available. Financial service regulators might well be required to participate in the oversight of this role, and financial services legislation and regulation might have to be adjusted to allow it. Whether required by utility regulators or financial service regulators, utilities should be able to offer their customers a low rate of interest comparable to the utility’s own borrowing costs, because the utility would have the loan security necessary to attract its own low-cost capital based on the property value. Abuse by utilities of the option to loan capital to their customers and link the loans to the underlying property would be possible, and regulators should be sensitive to any such abuse and empowered to stop it. However, putting the utility company into the position of making a return for assisting customers to capitalize on and economize on utility services is a key goal of the pilot design, and this is one way of achieving that goal.

This would not only constitute a new and productive customer relationship, but a significant new business line. The utility could also potentially gain clean-energy and efficiency credits generated from the properties on which the improvements were financed.

4. Automated Microgrids

Reliability and resiliency are the two aspects of utility service that are most important and were most conspicuously missing in recent years; they were the factors that launched the inquiry that led to this pilot project design effort.

There is good consensus that among the most effective technical advances that can measurably increase reliability and resiliency (bounce-back from weather-related outages) is the use of automatic sectionalizing and reclosing equipment, manipulating the distribution-system switches to reconfigure the flow of power to all those areas not directly affected by downed wires or transformer failures, maximizing continued service. The Energy Future Coalition learned of the significant and positive experiences of such cities as Chattanooga, Tennessee, and Naperville, Illinois, who have employed this technology.

Both Maryland utilities are already implementing such sectionalizing and reclosing equipment to some extent. And indeed, BGE itself recommended the deployment of specific automated sectionalizing and reclosing equipment as an element of this pilot project design.

Recommending that Maryland's utilities maximize their system potential to transition to a "loop" system design for electricity distribution from a radial design to the extent possible, incorporating the automated sectionalizing and reclosing equipment that is now available, is therefore as close to a "no-brainer" as any of the pilot elements considered. Elements 1.1, 4.3, and 4.4 in Table 1 all relate to adding such capability. The pilot project design therefore proposes that they do so to the full extent compatible with their system design. Pepco signaled that it had evaluated its system and concluded that it was not equally amenable to a comprehensive conversion to a looped system. In the view of the Energy Future Coalition, Pepco should review all options and elements, and install looping with automated sectionalizing and reclosing wherever possible. The value of diminishing outages on Pepco's system and improving resiliency may warrant a significant investment in wires creating loops at the ends or elsewhere along the radial feeders that currently are dead whenever an outage occurs , and the associated automated switching and sensing devices, to allow power to back-feed on the radial lines from other sources.

What is not so generally understood is that the same sectionalizing and reclosing can segregate system areas that can then become "microgrids," which could use the utility's own wires, rather than traditional microgrids such as campuses with their own distribution network. "Microgrid" should be defined as an integrated energy system consisting of distributed energy generating resources, both conventional (such as gas-fired combined heat and power systems providing thermal energy to buildings or industrial processes) and renewable generation such as solar roof panels, multiple electrical loads or meters (or both), and energy storage, operating as a single, autonomous grid either in parallel to or islanded from the existing utility power grid. In the most common configuration, a group of distributed energy resources are tied together on their own feeder, which is then linked to the larger utility grid at a single point of common coupling. New controls, more efficient heat capture, micro-storage, and a variety of IT innovations decentralize and differentiate "microgrid" energy service provision from conventional power infrastructure.

This pilot design proposes that the utility and willing customers in a neighborhood, office park, subdivision, or other geographic sub-region could form a microgrid by jointly, at a minimum, establishing back-up power capacity that could come on automatically when the grid is down (or when a cyber attack threatened to take it down), to operate safely while islanded from the central grid until the crisis was over. The reliability back-up power function might combine with the integrated systems of controls mentioned earlier to ensure that the back-up power would be limited to critical needs of lighting, telecommunication, and basic human needs, by remotely turning off large loads that are not critical, in the likely event that the back-up power was not sufficient to meet all load on an ongoing basis. The evidence gathered by the Energy Future Coalition in this project suggested that such microgrids could significantly improve the possible degree of reliability.

However, the microgrid functionality could go well beyond the minimum needed for better reliability in such a “back-stop microgrid.” Utility deployments of smart grid technology designed to increase operational and reliability efficiencies, such as distribution and substation automation, could ultimately lead to smart management systems that, when coupled with advanced energy storage, would become more or less a fully-functional local utility optimizing service to local customers. At this point, there is insufficient operating experience to address when distribution automation and substation automation would cross the line to become such a “full-function microgrid,” but this pilot project could potentially help provide that experience.

Such a microgrid might find its back-up power in a combined-heat and power facility normally providing thermal energy and part of the system load of a major customer, or from a stand-by generator installed by the utility itself at the substation. In that event, it would certainly make sense to understand when sheer economics would warrant providing power from those units to the microgrid area even while the broader grid was not suffering an outage. Doing so would require a real-time ability to compare the economics of the local generation to that available on the broader grid, real-time knowledge of the degree to which surplus power was available from the local sources, a real-time decision-making function to elect the best source of power for the microgrid customers, and the ability to segregate the costs and charges so the microgrid customers realize the benefits of that capability.

Such a microgrid would also integrate renewable energy capacity from within its area, allowing that capacity to continue to function during an outage that would otherwise require it to be disconnected from the grid, and providing additional economic justification to making the renewable capital investment in the first instance. This might also justify a variance in those microgrid-serving renewable energy generators’ responsibilities for system costs or compensation through net-metering rates, since that generator would be providing different and more valuable services within the microgrid than could renewable generators on the broader grid.

Such a microgrid might offer the perfect opportunity to integrate electricity storage in the form of batteries or flywheels sized to maintain local loads, storage also capable of absorbing local power surges or deficits caused by renewable energy intermittence. Storage technologies might thus provide a voltage-regulation and frequency control service that made the microgrid’s operations more feasible and economic, warranting compensation that would in turn make the storage technologies more economic in a microgrid context.

The occupants of the microgrid area would presumably be responsible for at least a portion of the capital and operating costs of the local generation that would keep them going in an outage, as well as for other related capacities facilitating their ability to island from the broader grid whenever it made sense or made money to do so. They might, on the other hand, deserve a break for system capacity costs charged to customers elsewhere on the grid to the extent their own capacity investments made them less reliant on the broader system. As with other customer-side investments, it would be helpful if they could again amortize any related capital cost over an extended period on their utility bills, which might otherwise be sharply reduced.

Certainly when the microgrid utilized the utility's own wires, but probably in every instance, the customers on a microgrid would be obliged to accept the utility-selected suite of controls and monitoring on major uses that could be remotely managed. The utility would be responsible for the system devices necessary to isolate the microgrid in an outage and for the signal to the microgrid when it should start and stop its separate operation, as an element of the utility's general responsibility to maintain reliability to the degree possible. However, when customers also made the wires investments in creating a microgrid, they might elect to provide their own system control function as well, but would obviously have to remain in close communication and coordination with the broader utility.

From a legal and regulatory perspective, it is doubtful that a new microgrid could be established that served customers who paid the microgrid's operators for its services without constituting a new public utility requiring regulation by the public utility commission and without carving out an area of the utility's franchised monopoly service area, especially if the utility's wires and service were already established in the area. This would be a difficult, lengthy, and probably heavily contested proceeding to carry through to completion, if it were successful. Utilities are not generally very enthusiastic about seeing their service territories parceled out into smaller independent enterprises, and there is insufficient evidence at this point that the potential economic and reliability advantages of a microgrid would more than offset the economic and reliability advantages that come from the scale of a larger central utility operation. But there is merit in testing and understanding the potential economic and reliability advantages that may come from microgrid implementation within a broader utility grid. It is not inconceivable that the optimum architecture of the utility of the future would be as the central coordinator of a set of islandable microgrids achieving their own economic and reliability potential. And separate ownership and control would not be necessary to test the merits of microgrid architecture and functionality for benefit of the customers of an area. It would be much easier for those customers and their utility to collaborate in selecting, installing, financing, and operating the equipment and systems required to create one or more full-function microgrids, examining together how their operational and cost factors compare to and fit within the broader grid, than for them to fight over such turf, tests and lessons as adversaries and competitors. Both the utility and its customers would gain from cooperating on a pilot project testing the feasibility and economics of one or more "full-service microgrids," starting with testing the reliability potential of "back-stop microgrids," and that is what this pilot project design recommends.

5. Electric Vehicle Charging as an Asset to the Grid

Among the few areas where electric utilities might expect a significant increase in future load is the potential for wide-spread use of electric battery drive vehicles. In every other sector besides transportation, load looks to be driven lower over coming years by improved application efficiency, better building efficiency (77% of electricity is consumed in buildings), competitively-driven market efficiency for power and electricity services, and smart-grid system-contol and management efficiency. A large fleet of electric battery vehicles could more than offset these declines due to the amount of power their batteries hold.

Encouraging electric vehicle purchases and use could therefore support utility industry revenues, investments and maintenance over time. Timing the charging of these vehicles, on the other hand, if not managed, could create major problems for the grid, overwhelming suburban substations as commuters return and plug their battery-powered cars into their home charging stations. If managed by the utility, charging electric vehicle batteries could be a significant asset to the grid, particularly in places where power surges or voltage reductions can come quickly without warning, such as where there were significant concentrations of solar photovoltaic collectors subject to short-term swings in output from cloud shadows.

While there is continuing question about the ability of vehicle batteries to deliver useful power back to the customer or to the grid – and threats that such use would constitute vehicle battery warranty violations – there is no question that turning vehicle-battery charging on and off does not hurt the battery and might help the grid. The pilot design therefore proposes that utilities offer voltage regulation and load control compensation to electric vehicle purchasers whose owners would be willing to make the timing of charging the vehicles a function that the utility could control, subject to ensuring a minimum battery charge at a customer-set given time each day. A utility with a well distributed fleet of electric vehicle batteries that it could charge or cease charging of as a function of system voltage and load requirements could be a utility with high quality of service, a key attribute of reliability in a computerized society. That utility could also be much more ready to accept significant quantities of variable renewable energy generation with a meaningful and potentially growing market to send it to.

For vehicle purchasers, this could justify a one-time payment of perhaps $500 to $1,000 by the utility toward the initial high EV purchase price – the principal deterrent to wider acceptance of EVs – premised on an agreement to make the vehicle available for timed charging. The amount would need to be enough to make the deal attractive for a new vehicle purchaser already paying a premium of several thousand dollars above the cost of a conventionally-powered vehicle of the same type. The customer would agree to repay the rebate if he or she did not maintain the vehicle or agreement for a requisite period of time based on the projected value to the utility. Electric vehicles at the University of Delaware are currently earning more than $100 per month per vehicle offering voltage regulation service, so the utility might be able to justify a significant rebate with a one-year firm agreement.

For purposes of the pilot project, the makers of electric vehicles should be asked to offer residents of the pilot project area a special purchase price discount below the standard retail sales price. They should be excited about the potential of the pilot to stimulate new markets for their vehicles, should compete with each other to see who can sell the most vehicles in the pilot area, and they should definitely not be permitted to price the vehicles in a manner that makes them the de facto recipients of the value of the utility rebate or purchase-price contribution. The utility should perhaps offer the rebate to those vehicles purchased at a price already discounted from the manufacturer's recommended retail price by the amount of the rebate, effectively doubling the discount the manufacturers are willing to offer.

It might be possible as well for the utility to offer a steeply discounted rate for the power put into the battery, based on the savings from not having to employ other means of stabilizing the system such as employing spinning reserve in generation or demand response. This would require the capability to identify a given vehicle to its owner even when charging outside that owner's premises, a capability that could readily be built into the charging control software and firmware.

For owners of office buildings, shopping centers, parking lots, and other central facilities with daytime parking, the utility could offer similar incentives and support for the charging stations. In both cases, the utility could be responsible for installing the ability to dispatch power to the vehicles when appropriate. The value of the access to the parking space is, in many cases, high enough to the property owner and the customer that the power dispensed by the charger could be given to the vehicle owner at no additional charge or at a heavily discounted rate as an enticement to utilize the parking. With longer-term and overnight parkers, the utility and the customers might be able to save capital costs by installing Level 1 chargers (at 120 volts) rather than the much more expensive albeit faster Level 2 (240-volt) chargers.

Customers agreeing to the utility purchase-price bonus and agreement would also have to have accepted and installed at least as much of the utility's suite of recommended smart-grid equipment as necessary to implement the vehicle agreement, and could potentially finance their home vehicle charging equipment through on-bill financing, as it would be a permanent feature of the property.

Regulatory Model Adjustments

This pilot project design anticipates a significant change in the business model for Maryland's utilities, and that implicates a number of parallel changes in the regulatory regime the Maryland Public Service Commission conducts in ensuring that the utilities operate in the public interest.

In addition to adopting the five performance factors mentioned above as key factors driving the utilities return on equity, the PSC would have to adopt the metrics that would measure the utility's actual performance in accordance with those factors, and would have to perform that actual measurement from time to time. To be most useful to the utilities and most accurate in incenting utility behavior, these metrics would ideally be established with some parallels to the geographic footprint that was represented in the customer priority-setting exercise.

In addition, the PSC is asked in this pilot project design to endorse and supervise an extensive program of utility financing assistance to customers to support customer take-up of smart grid technology as well as more efficient appliances and buildings. Only with PSC approval should utilities lend money to customers to be repaid on utility bills that might be sent to those customers' successors in that property. But only if utilities have the ability to make downstream investments in smart-grid capability beyond their own systems and in efficiency are they likely to retain a sufficient base of investment to keep their current financial capacity and scale. The Energy Future Coalition believes that it is very much in their customers' interest that they do so, and also that utilities be allowed to offer up-front capital for long-term efficiency investments the customers themselves may not have.

Similarly, the PSC would have to adopt one or more time-sensitive rate structures that utilities, customers, and the suite of integrated control, information, and monitoring equipment could utilize. To the extent the time-variance of prices reflected energy cost differentials, the PSC and the utilities should encourage energy suppliers to offer real-time energy on a passthrough-plus-modest-margin basis, presumably reflecting a lower profit margin than on the flat-rate pricing suppliers now tend to use, since they are taking more risk of spikes and valleys themselves than if they passed those variations through to customers. Some of these changes may be tricky to develop merely for a pilot project, but adopting them would be important for truly understanding the customer reaction and utility outcomes of these proposals.

Utilities, backstopped by their customers, should pay for valuable services that they receive in the operation of the grid, and that includes services received from the customers themselves. With new smart grid technologies, potential for storage from vehicles and otherwise, and the ability to use their power consuming water heaters, refrigerator compressors, air conditioning compressors, swimming pool pumps, and other devices as temporary means of helping the grid, customers are entitled to have the value of their offering reflected in some meaningful fashion. They should not be seen as utilities themselves, but the value and form of their payments from the utility clearly warrants regulatory oversight. In order to encourage the optimum level of investment in such capability, the utility should indicate the scale of its potential desires to purchase such services, and the range of costs that it might be willing to pay for them, based on the costs of meeting the same needs in alternate ways. Regulators should review and validate such schedules, and provide prospective assurance that such transactions would be considered prudent within their designated scale and scope. This would then enable consumers to work with utilities under known economic conditions to provide such ancillary benefits to the grid.

Another proposal for adoption in the pilot project is that the utility be permitted to demonstrate and retain for its shareholders a portion of the savings in cost of service achieved by improving system automation, control, and voltage regulation through installation of equipment, including the equipment installed by the utility for its customers, for the first two years of the pilot. The savings would be determined by calculating a base period cost of system operation, normalized for weather, inflation, and other factors outside utility control, and then comparing that to the costs of system operation after the greater automation, information, monitoring, and control is installed. Since the utility is recovering its own costs of investment and a return, such savings would normally flow through to ratepayers. However, as an additional incentive to market and move forward with system automation and ramping up the customer outreach and customer service that will be needed, the Energy Future Coalition believes that a temporary ability to retain some of the savings created would be an appropriate additional incentive, in addition to the upward boost to its rate of return the utility could earn.

Maryland utilities have an obligation to achieve a given level of energy efficiency gains, and the pilot design contemplates that they would be credited for those efficiency gains that are attributable to the equipment installed and/or financed by the utility, as well as the measurable gains from new customer options the utility makes possible. The potential for such gains should, however, be taken into account in adjusting the targets for future years.

#	Name	Title	Organization	E-Mail Address	Phone Number	Relevant Categories
1	Mark Madden	Regional Vice President, North American Utilities	Alcatel-Lucent	Mark.madden@alcatel-lucent.com	(818) 598-6238	2.1, 2.2, 3.1, 4.2, 5.2, 5.3
Synopsis of Ideas/Proposals/Interests: Wireless broadband communications infrastructure shared with public safety and the cloud-based computing infrastructure that will be required for improving grid reliability through automated grid segmentation and to preserve grid stability during large-scale adoption of renewable energy resources and microgrids. There are no "smart grid" and reliability initiatives that can be successful without first providing the means to communicate with the equipment and analyze the data that comes from it. By partnering with Public Safety and FirstNet, the wireless broadband deployment for both the utilities and Public Safety can be paid for just once, rather than build multiple networks to support these initiatives – sharing the costs between the two.						
2	Paul Centolella	Vice President	Analysis Group	pcentolella@analysisgroup.com	(617) 425-8182	
Synopsis of Ideas/Proposals/Interests: Provided information on the development of an integrated strategy for demand optimization, see: http://www.analysisgroup.com/uploadedFiles/Publishing/Articles/2012_Centolella_Dynamic_Pricing.pdf; alternative ratemaking and recognition of the value of uninterrupted service to difference customers, see: http://magrid.raabassociates.org/Articles/Centolella%20_12.17.12.pdf.						
3	Dan Delurey	President	Association for Demand Response & Smart Grid	Dan.delurey@demandresponsesmartgrid.org	(202) 296-1686	2.1, 2.2, 2.4, 3.1, 4.2, 5.2, 5.4
Synopsis of Ideas/Proposals/Interests: Implementation of DR and Smart Grid technologies and programs						
4	Dave Nickerson	Director of Business Development	Beacon Power, LLC	nickerson@beaconpower.com	(978) 661-2029	3.2, 4.1, 6.4, 6.8
Synopsis of Ideas/Proposals/Interests: Utility pilot program. Co-locate a high power, fast response flywheel energy storage system with a large solar PV facility. Use to smooth output variability and mitigate local voltage flicker issues. Provide frequency regulation services at night to PJM as a supplemental revenue stream.						
5	Jill Sorensen	Executive Director	BEVI, Inc.	jatsorensen@gmail.com	(443) 514-7122	
Synopsis of Ideas/Proposals/Interests: EV-PV-ES positioned at Maryland National Guard posts for emergency response preparedness						
6	Prateek Chakravarty	Head - Business Development, Sales & Marketing	Bidgely	prateek@bidgely.com	(415) 350-7780	2.1, 2.2, 2.4, 3.1, 4.2, 5.2
Synopsis of Ideas/Proposals/Interests: Extract appliance-specific consumption insights from Smart Meter data non-intrusively (without putting plug level sensors inside the home). Such insights help utilities leverage the Smart Meter investment and realize increased energy and demand reduction through enhanced consumer engagement and effective utility operations.						
7	Jessy Borges	BD Specialist	Bloom Energy	jborges@bloomenergy.com	(408) 543-1687	
Synopsis of Ideas/Proposals/Interests: Bloom Energy Corporation can supply an unparalleled combination of the right technology, specific experience, and partners to make the Maryland Grid Resiliency Task Force Pilot Project a success.						
8	Craig Lewis	Executive Director	Clean Coalition	craig@clean-coalition.org	(650) 204-9768	1.1, 1.2, 2.1, 3.1, 3.4, 4.3, 5.3, 6.4
Synopsis of Ideas/Proposals/Interests: The Clean Coalition's Distributed Generation + Intelligent Grid (DG+IG) Initiative demonstrates that at least 25% of the total electric energy consumed can be provisioned by local renewables within the distribution grid, while maintaining or even improving grid reliability. Each demonstration project focuses on the grid area served by a single substation and illuminates the technical and financial feasibility of high penetrations of DG. The Clean Coalition is already moving DG+IG projects forward in the Virgin Islands and California. A DG+IG project would be very straightforward to deploy in Maryland, under existing policy/market structures and with little capital requirements.						
9	Todd A. Headlee	Director	Dominion Voltage Inc.; Dominion Resources, Inc.	theadlee@dvigridsolutions.com	(804) 819-2328	2.1, 2.2, 4.2, 6.8
Synopsis of Ideas/Proposals/Interests: DVI is a leading provider of grid optimization technology providing solutions for energy efficiency, demand response and volt/VAR control. DVI's patented approach plans, manages and validates utilities' investments in grid modernization while delivering significant energy savings to both utilities and their customers. DVI's EDGE® technology coupled with AMI can elevate success of the following applications: Energy Efficiency (Conservation Voltage Reduction); Demand Response; Integration of Renewables; and Power Factor Correction.						

<table>
<tr><td>10</td><td>Walter McLeod</td><td>President</td><td>Eco Capitol LLC</td><td>mcleodwl@ecocapitol.com</td><td>(540) 848-1340</td><td></td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests: Energy policy and investment advisor.</td></tr>
<tr><td>11</td><td>Everitt Long</td><td>Director of Intellectual Property</td><td>ecobee, Inc.</td><td>everitt@ecobee.com</td><td>(403) 670-6779</td><td>2.1, 2.2, 2.3, 3.1</td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests: Heating/cooling represents 50-70% of the energy costs in the average home. Inexpensive devices like smart thermostats can reduce HVAC energy consumption by approximately 24%.</td></tr>
<tr><td>12</td><td>John Finnigan</td><td>Senior Regulatory Attorney</td><td>Environmental Defense Fund</td><td>jfinnigan@edf.org</td><td>(513) 226-9558</td><td>5.1, 6.1, 6.2, 6.3</td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests: Develop a performance-based incentive system for electric distribution utilities based on the “RIIO” (Revenues = Incentives + Innovation + Outputs) model adopted in England. A summary of the model is contained in the fact sheet attached to this email.</td></tr>
<tr><td>13</td><td>Brian J. Deaver, Sr., P.E.</td><td>Technical Executive</td><td>Electric Power Research Institute</td><td>BDeaver@EPRI.COM</td><td>(443) 910-2553</td><td>1.1, 1.2, 3.4, 4.3, 4.4, 5.3, 6.4, 6.6</td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests: EPRI provided technical input on the smart distribution system and how it can improve resiliency and storm restoration. EPRI has broad expertise in all areas of Distribution Reliability, Design, Operations, Maintenance and Automation. We are actively performing research into the areas of Grid Resiliency and MicroGrids and would be interested in participating in pilots that result from this work.</td></tr>
<tr><td>14</td><td>Tony Barnes</td><td>Director Client Solutions</td><td>EnergySavvy</td><td>abarnes@energysavvy.com</td><td>(617) 365-5059</td><td></td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests: Improve structured stakeholder communications (utility, homeowner, contractors, loan providers, manufacturers, etc.) by leveraging a software platform for transparent information sharing, data transfer, and alerting. Streamline and automate outbound communications activities where possible and appropriate, including encouraging enrollment into qualified programs. Maintain a utility Energy Efficiency Management System to standardize data collection and reporting.</td></tr>
<tr><td>15</td><td>Jackson Wang</td><td>President</td><td>e-Radio Inc.</td><td>jwang@e-radioinc.com</td><td>(408) 469-4376</td><td>2.1, 2.2, 2.4, 2.5, 3.3, 4.2, 4.3</td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests:
1. e-Radio partners with national public and private FM radio networks to broadcast local smart grid information to a wide range of energy consuming devices via local stations. We believe the characteristics of FM broadcast are particularly attractive for Utility 2.0:
a. Full nation wide coverage leveraging existing infrastructure. Enabling digital smart grid broadcast to full market within weeks and months not years.
i. http://www.prss.org/news-10-26-11.html (example of public FM network leverage)
b. Unlimited simultaneous listener devices (point to multi-point)
c. Preserves end user privacy
d. Broadcast architecture enables consumer choice by providing up to the second information with full end user control including overrides at any time.
i. Demonstration of (e-Radio/NPR/PRSS) architecture in action (w/ EPRI staff)
1. http://www.youtube.com/watch?v=RGy0GTMLdYQ (@ Grid interop via KJZZ, Phoenix, AZ)
2. http://www.youtube.com/watch?v=5STwVaw01_U&hd=1 (@ AEP Dolan Labs via WOSU, Columbus, OH)
3. There are some 53 million electric hot water heaters in the US market, each consuming some 2.5 to 5.0 kW when on. Thermal energy storage value of a 50 Gal tank is apx the same as the 16KWh battery in a Chevrolet Volt. The ability to “connect” them will affect more power in real time than the entire US nuclear generation fleet.(>100GW)
e. Documentation of real time broadcasting of smart grid info to Chevrolet volt via a GM/e-Radio IEEE paper (June 2012)
i. PS-10 session of the http://itec-conf.com/previous-itecs/itec-2012
f. Independent but complimentary to optional HEM (home energy management) systems
g. EPRI CEA 2045 description
i. http://www.smartenergyuniverse.com/spotlight/12265-cea-2045-the-smart-grid
ii. http://www.ce.org/Standards/Standard-Listings/R7-8-Modular-Communication-Interface-for-Energy-Ma/CEA-2045.aspx
2. In addition to utility applications, emergency notification may be of interest to the Governors office as well. The potential use of an FM & battery backed PCT (Programmable Communicating Thermostat) can perform blackout advisory AND emergency notification applications. We are currently looking at a “public alerting” project with NPR labs possibly using the PCT as follows:
a. http://www.rcstechnology.com/images/pdfs/rds-communicating-thermostat.pdf
3. e-Radio technology has been in numerous demonstration and pilots in CA, AL, AZ, DC, NV, KY,TX, IN and OH. Our primary broadcasting partners in these field works have been various local NPR stations. Tour of the new NPR facility in DC is possible beginning sometime in Q2 2013.</td></tr>
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16	Navi Singh	Head of Solutions Delivery	Essess, Inc.	Navi@essess.com	(415) 361-5488 x107	-
Synopsis of Ideas/Proposals/Interests: Essess is a technology company focused on improving homeowner comfort and building energy efficiency. Using technology developed at MIT, we capture thermal images of millions of homes per month. We augment and analyze these images with additional data to produce a custom, confidential homeowner report that identifies ways to improve comfort, lower interior noise pollution, and reduce energy bills. We focus on providing a solution that will help engage consumers in a conversation around energy efficiency for the long term.						
17	Kurt Yeager	Vice Chairman	Galvin Electricity Initiative	kyeager@galvinpower.org	(831) 786-9832	
Synopsis of Ideas/Proposals/Interests: Electricity is the lifeblood of every state's economy and quality of life. Today, the obsolete and very poor quality of electricity service rob thousands of dollars every year from each household customer while seriously threatening the environment and wasting immense amounts of energy. The transformation of electricity service to meet 21st century requirements is essential to resolving the serious economic, productivity, environmental, and energy security threats to all our states and their citizens. The Galvin Electricity Initiative and our Perfect Power Institute have developed a distribution Microgrid architecture to most expeditiously achieve this electricity service quality transformation. It is being successfully demonstrated with a number of communities and campuses nationwide. This Microgrid architecture and its performance standards make an excellent basis for the Utility 2.0 project with major benefits to utilities and all their customers. The Galvin Electricity Initiative and the Perfect Power Institute are prepared to help in any way we can to achieve Maryland's Utility 2.0 project goals.						
18	Larisa Dobriansky	Senior Vice President Legal, Regulatory and Policy	General MicroGrids	larisadobriansky@generalmicrogrids.com	(703) 920-1377	1.1, 1.2, 2, 3, 5, 6
Synopsis of Ideas/Proposals/Interests: (1) Reliability and Resiliency – role of smart microgrids in contributing to a more resilient power system, including by managing and optimizing local energy networks; guidance on cost-effective, smart grid investments to improve distribution level power reliability, power quality and resource availability in furtherance of national, state and local energy assurance plans and emergency response and restoration protocols; (2) and (3) Residential Customer and Large Customer Optionalities – Advice on pilot design based on participation in ARRA-funded and other public supported "game-changing" smart grid demonstrations and familiarity with the design and implementation of most of USDOE's funded smart grid demonstrations; (4) and (5) Utility Business Models and Regulatory Models – Expertise regarding needed regulatory and legislative changes for a new power operating paradigm, as well as relating to new "inform and motivate" approaches to replace "command and control" approaches for aggregating and making visible and available new demand side and distributed energy resources to utility distribution systems, overall power systems and the market, using software-based intelligence in smart grid modernization; General MicroGrids' founders are responsible for advancing "hierarchical and Grid-Agents" software-based, control systems.						
19	Rolf Nordstrom	Executive Director	Great Plains Institute	Rnordstrom@gpisd.net	(612) 278-7156	
Synopsis of Ideas/Proposals/Interests: We have an emerging project called "e21," dedicated to developing a 21st century regulatory framework that rewards utilities and others for achieving a sustainable, carbon-neutral energy system by mid-century. Xcel Energy is the main utility partner, and we expect to work with George Washington University Law school as well. We are thus keenly interested in what Maryland is doing to reimagine its regulatory framework.						
20	Richard Hammond	Sr. VP	GRIDiant Corporation	Richard. Hammond@gridiantcorp.com	415-846-2688	1.1, 1.2, 2.4, 2.5, 3.2, 3.3, 3.4, 4.1, 4.3, 4.4, 5.1, 5.2, 5.3, 5.4, 6.6, 6.7, 6.8
Synopsis of Ideas/Proposals/Interests: GRIDiant has developed and is deploying a commercial-grade, fully-tested Advanced Grid Management Platform for development of dynamic, detailed, 3-phase (balanced and unbalanced), bus-level models/simulators for entire distribution (or integrated T&D) networks, using historical data and data streams from 2 or more of a utility's GIS, AMI, SCADA/DA/DMS, OMS, OSI (historical), LMS (load management), CIS, ERP (enterprise resources) systems, and displaying the network in a variety of dynamic formats including Google Maps®, Google Earth®, and annotated line drawings. Driven by the GRIDfast™ optimization, ranking, and analysis engine, the simulator runs a range of engineering economic analytics applications and displays the results in near-real-time and real-time, including analysis/display applications for optimized placement and dynamic integrated dispatch of DER (DR,DG/PV, storage), reliability optimization, loss minimization, DA placement and switching optimization, EV infrastructure design and charging, optimal Volt/VAr and CVR design and control/dispatch, diversion detection, and fault isolation (sectionalization & reclosing) and optimized, real-time system reconfiguration and service restoration (including dispatch of DR/DER if available). GRIDiant offers functionalities for and is interested in participating in network and infrastructure modeling/simulation, analytics, visualization/display tasks involved in the project.						
21	Meg Hardon	Senior Government Relations Advisor	Kelley Drye & Warren LLP	mhardon@kelleydrye.com	(202) 342-8470	2.1, 2.2, 2.3, 2.4, 3.1, 4.2, 5.2
Synopsis of Ideas/Proposals/Interests: There is a ripe opportunity for an identity/authentication project, in cooperation with the National Strategy for Trusted Identities in Cyberspace office at NIST. The treasure trove of consumer energy usage data (CEUD) available through the Green Button program lends itself to the development of consumer apps. These apps would allow consumers to make easy use of the data to reduce energy consumption, through time of use pricing, for example. Also imaginable is an app that might allow you to download your usage data for a specific appliance when you are out purchasing a new dishwasher, for example. How will the utilities manage the access to that data securely through the cloud, or allow consumers access to that data to deliver it to third parties providing services?						

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<tr><td>22</td><td>Todd Hodrinsky</td><td>President</td><td>LiteSheet</td><td>toddh@litesheet.com</td><td>(860) 634-1790</td><td>5.4, 6.4, 6.5, 6.7</td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests: Founder of new technology for LED lighting that is most efficient lighting source in the world. After listening to the presenters at the event in Washington DC. I would suggest that we hold a vendor/manufacturer round table meeting to discuss how the products could be integrated into a smart grid. This collaboration would be utilized for the purpose of creating a better energy grid, while improving the appliances that reside on the grid itself. For example: There was a company that was in process of developing wireless monitoring technology for the utility. This technology could be easily modified to allow consumers and the utility to login to customer accounts online and monitor the lighting systems in their homes. Turning lights on and off, showing consumers where the most energy is being used in their homes and so on.</td></tr>
<tr><td>23</td><td>Fereidoon Sioshansi</td><td>President</td><td>Menlo Energy Economics</td><td>fpsioshansi@aol.com</td><td>(925) 256-1484</td><td></td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests: To use Utility 2.0 project as a case study in an edited book tentatively titled Utility Version 2.0</td></tr>
<tr><td>24</td><td>Jeffrey King</td><td>Principal Environmental Planner</td><td>Metropolitan Washington Council of Governments</td><td>jking@mwcog.org</td><td>(202) 962-3200</td><td>1.1, 1.2, 2.5, 3.3, 3.4, 6.5</td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests:
Proposed criteria to assist in prioritizing pilot project proposals. Pilot program will:
1) Support new national initiatives such as:
*Employer workplace energy solutions - EV charging, load response, energy awareness thru technology
*Better Buildings Challenge/High Performance Buildings
*National Energy Efficiency Network
*Green Power Communities
2) Involve Collaborative Procurement (regional solar initiative)
3) Involve benchmarking and data sharing on energy performance
4) Include collaboration with federal Greening Initiatives (GSA's Greening Initiative for the National Capital Region)
5) Leverage newly deployed Maryland Clean Energy Center (MCEC) bonding authority
6) Use the MD state Energy Performance Contract vehicle
Consider collaboration with Department of Defense and military bases in the region which are advancing net zero goals and more widespread deployment of renewables, microgirds, and electric vehicles (e.g., Fort Detrick).
Secure funding to prepare a conceptual design; and, after securing partners, utility participation, and regulatory approvals, hire vendor to design, build, construct, operate, and demonstrate a civilian-sector microgrid.
Focus on pilot testing electric vehicle to grid concepts, and renewables to EV concept.
Focus on developing a “Smart Grid Nodes” concept.
Fund a new strategically located “Renewable Energy Park”. Consider enabling such a community asset to serve as an energy test bed and demonstration site. Consider whether such an asset could be equipped with own substation, have that substation serve as a backup to a substation that is serving two critical feeders to Critical Infrastructure, like water utility pump station.
Co-locate multiple new generation resources (solar, wind, biogas, fuel cell, etc) at a critical municipal site (wastewater plant/landfill) that will generate sufficient power to not only provide on-site power to the facility during normal operations, but also enable export of power from the site during a power emergency. (credit Bob Agee, former City Manager of Annapolis)
Fund tabletop exercise and planning charette to identify strategic locations on where to place new distributed energy generation resources, particularly in areas that can support Critical Infrastructure.
Consider partnering with http://www.clean-coalition.org/ to launch a CLEAN program in Maryland.</td></tr>
<tr><td>25</td><td>Jay Morrison</td><td>VP-Regulatory</td><td>National Rural Electric Cooperative Association</td><td>Jay.morrison@nreca.coop</td><td>(703) 907-5825</td><td></td></tr>
<tr><td colspan="7">1) Focus on safety, reliability, and affordability of electric service.
2) Adopt policies/procedures/technologies only if, to the extent that, and on a schedule that enhances utilities’ ability to provide safe, reliable, and affordable service.
3) There are local differences and differences for different utilities on what policies/procedures/technologies enhance the ability to deliver safe, reliable, and affordable service. Recognize those differences in implementation decisions and schedules.</td></tr>
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<tr><td>26</td><td>Jon Baylor</td><td>Senior Director, Development</td><td>NRG Energy, Inc.</td><td>Jonathan.baylor@nrgenergy.com</td><td></td><td></td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests: See #28</td></tr>
<tr><td>27</td><td>Siddhartha Sachdeva</td><td>Senior Director, Innovation</td><td>NRG Energy, Inc.</td><td>Siddhartha.Sachdeva@nrgenergy.com</td><td></td><td></td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests: See #28</td></tr>
<tr><td>28</td><td>Steven Arabia</td><td>Director, External Affairs</td><td>NRG Energy, Inc.</td><td>Steven.arabia@nrgenergy.com</td><td>(240) 620-4441</td><td>1.1, 1.2, 2.1, 3.1, 3.4, 4.3, 5.3, 6.4</td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests: NRG encourages policies that support micro grid and distributed generation projects. NRG looks forward to participating in the development of a pilot project or projects.</td></tr>
<tr><td>29</td><td>John Kelly</td><td>Director</td><td>Perfect Power Institute</td><td>jkelly@perfectpowerinstitute.org</td><td>(630) 464-7020</td><td></td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests:
1. Utility led distribution reliability pilot for a targeted area whereby the utility working with the local governments and stakeholders implements their full suite of smart grid technologies with input from the stakeholders on process and technology innovations that would improve the outcomes, lower costs, or assist with customer engagement. The reliability pilot would include deployment of an optimized recovery plan including improvements to interfaces with local police, fire, governments, business, and customers.
o Utility benefit – improved process and independent validation of their smart grid approach
o Customer value – reliability improves by XX%
o Local government value – local government input into utility plans and priorities, as well as, improved outage recovery process
o PUC value – improved smart grid process and local government support lowers smart grid costs
2. A stakeholder led process to develop an emergency and energy plan. This would include identifying all key facilities and selecting a few key facilities to participate in the pilot by investing in the capability to island based on establishing a process for fully valuing ancillary services from the key facilities (e.g. real time price, DR, voltage, reactive power, utility event, frequency, etc..).
o Utility value – ancillary services, retains 80%+ of load, voltage support, reactive power, support during upset conditions
o Customer value – island capability, reduced operating costs, revenue from ancillary services
o PUC value – lower system costs, lower energy costs
o Local government – key facilities available during major events that disable the grid
3. A utility commission led process for developing advanced policies and riders to double or triple smart grid investments:
o New rider enabling local governments to invest in grid improvements done by the utility. See Illinois Rider LGC as a model
o Expanded utility offered ancillary service shared savings programs (voltage support, demand response, event response, etc…)
o Storm recovery and response program/incentives - Package of incentives for key facilities that install islanding capability (e.g. enter real time market and provide ancillary services. In return they receive free interconnect and standby charged is proportional to site self-generation.
o New development rider to shift limited investment from system expansion to existing local smart grid improvements – A five year rider to recover the full cost of all distribution system improvements needed to serve new load while offering participation in the Island Rider to encourage islanding/ancillary service capability for new developments.</td></tr>
<tr><td>30</td><td>John McCauley</td><td>VP Sales – Northeast Region</td><td>Petra Solar</td><td>John.mccauley@petrasolar.com</td><td>(732) 476-4218</td><td>1.1, 1.2, 3.4, 5.3, 5.4, 6.4, 6.5, 6.6,</td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests: Enable utility ownership of solar to support progressive investment in grid tied smart solar with grid stabilization & energy efficiency benefits. Support investment in targeted microgrid projects to support critical infrastructure</td></tr>
<tr><td>31</td><td>Steven Lovink</td><td>Founder</td><td>Planet2025 Network</td><td>jslovink@planet2025.net</td><td>(202) 333-8878</td><td>3.1, 4.2, 6.7</td></tr>
<tr><td colspan="7">Synopsis of Ideas/Proposals/Interests: Pilot(s) for statewide initiative to save 15 percent or more on building energy costs through cloud-based artificial intelligence driven technology for energy consumption management and creation of cash flows to additional energy efficiency improvements modeled on currently on-going pilots in State of Florida.</td></tr>
<tr><td>32</td><td>Dan Garvey</td><td>Director, Sales and Marketing</td><td>PowerRunner</td><td>Dan.garvey@powerrunner.com</td><td>(401) 339-0374</td><td>2.2, 3.1, 4.2</td></tr>
<tr><td colspan="7">Micro forecasting and energy analytics on the meter level to enable integration of dynamic load and generation resources and to proactively identify growing distribution level load pockets to avoid blue sky outages.</td></tr>
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33	Richard Sedano	Principal, Director, US Programs	Regulatory Assistance Project	rsedano@rapoonline.org	(802) 498-0710	5.1, 5.2, 6.1, 6.2, 6.3
Synopsis of Ideas/Proposals/Interests: Include performance indicia in a new business model that is not dependent on sales, and include communities in planning.						
34	Bob Bruninga, PE	Research Engineer	Research Engineer US Naval Academy Aerospace Dept	Bruninga@usna.edu	(410) 293-6417	2.5, 3.3
Synopsis of Ideas/Proposals/Interests: Governor authorize state employees with EVs to payin-to-plugin to existing 120v state outlets. In keeping with MD EV Councils determination that 97% of charging at work can be done on 120v outlets and recognizing the DOE's Workplace Charging Challenge.						
35	Michael Kaplan	Vice President of Marketing	Retroficiency	Mike.kaplan@retroficiency.com	(845) 304-2346	5.2, 5.4, 6.4, 6.5, 6.6, 6.7
Synopsis of Ideas/Proposals/Interests: Retroficiency proposes a pilot to test the effectiveness of its energy analytics-based software to increase energy efficiency participation amongst commercial customers and enable utilities to save more energy through efficiency programs, while simultaneously spending less on those programs. We can facilitate the piloting of such software and deliver third-party partners to help validate the effectiveness of such approaches.						
36	Laurie Burnham	Principle Scientist	Sandia National Laboratories	lburnha@sandia.gov	(505) 659-7761	1.1, 1.2, 2.1, 3.1, 3.2, 3.4, 4.2, 4.3, 5.3, 6.4
Synopsis of Ideas/Proposals/Interests: Sandia National Laboratories has considerable experience in the areas of research and development and demonstration for microgrids, smart grids, transmission systems and associated markets and policies. Some specific topics areas include microgrid design and operation, energy storage, photovoltaic integration, and advanced distribution automation. We would be happy to engage in any of these areas.						
37	Martin Goldenblatt	Director of Account Management	Sentient Energy	mgoldenblatt@sentient-energy.com	(508) 397-5779	2.1, 2.2, 2.4, 3.1, 4.2, 5.2
Synopsis of Ideas/Proposals/Interests: The demonstration of (Sentient Energy) sensors to measure and communicate in real time, current, faults and temperature at continuous points along the distribution network. This will allow for faster system restoration and improved network reliability through preventive maintenance.						
38	Jim Davich	Channel Manager	Silent Power, Inc	jdavich@silentpwr.com	(218) 833-2160	3.2, 4.1, 5.4, 6.4, 6.5, 6.6, 6.8
Synopsis of Ideas/Proposals/Interests: OnDemand distributed energy storage system that provides following benefits to the grid: peak demand reduction, dsitrbution capital deferral, ancillary services, wholesale monthly demand charge reduction, voltage regulation, VAR control, renewable integration, shifting, and firming, demand response capability, and backup power						
39	Justin Segall	Founder and EVP	Simple Energy	justin@simpleenergy.com	(303) 800-5465	2.1, 2.2, 3.1, 4.2, 5.2
Synopsis of Ideas/Proposals/Interests: The success of future utility programs will be contingent upon their ability to better engage their customers. Simple Energy's Customer Engagement Platform uses leading behavioral science, gamification, rewards and feedback to motivate customers to take control of their energy use. This new form of digital engagement provides higher customer satisfaction and program participation in addition to delivering measurable and verifiable Energy Efficiency (kWh) and Peak Load Reduction (kW) that meets the needs of utilities and regulators.						
40	Darren Deffner	Policy Director	Solar Electric Power Association (SEPA)	ddeffner@solarelectricpower.org	(202) 559-2020	1.2, 5.3, 5.4, 6.5, 6.6, 6.7, 6.8
Synopsis of Ideas/Proposals/Interests: Utility solar business models; innovative regulatory approaches to solar.						
41	John Monteleone	Consultant	Southbury Institute	john@southburyinstitute.org	(203) 565-6100	
Synopsis of Ideas/Proposals/Interests: Specialty in energy and sustainability education for public, private and governmental audiences.						
42	Jim Hawley	Senior Vice President	TechNet	jhawley@technet.org	(916) 594-7987	
Synopsis of Ideas/Proposals/Interests: Developing technology neutral, customer-facing, open ecosystem that maximizes opportunity for new innovations and third party business models in sectors like DR, EE, DG, EV charging.						
43	David W. South	President	Technology & Market Solutions, LLC	david@t-msolutions.com	(703) 795-2274	2.1, 2.2, 2.4, 3.1, 4.2, 5.2, 5.4
Synopsis of Ideas/Proposals/Interests: Deployment and integration of clean energy/distributed generation technologies within smart grid infrastructure together with pricing of services and environmental benefits.						

44	Scott Sklar	President	The Stella Group, Ltd.	solarsklar@aol.com	(202) 347-2214	
Synopsis of Ideas/Proposals/Interests: The Stella Group, Ltd.. is a strategic technology optimization and policy firm for clean distributed energy users and companies which include advanced batteries and controls, energy efficiency and chp, fuel cells, geo-exchange, heat engines, minigeneration (natural gas/propane), microhydropower and water energy (freeflow, tidal, & wave, etc.), modular biomass, photovoltaics, small wind, and solar thermal (including daylighting, water heating, industrial preheat, building air-conditioning, and electric power generation). The Stella Group, Ltd. blends distributed energy technologies, aggregates financing (including leasing), with a focus on system standardization.						
45	Brent Hollenbeck	Founder & CEO	TimberRock Energy Solutions	bhollenbeck@timberrockes.com	(877) 876-2588 x2	1.1, 1.2, 2.5, 3.2, 3.3, 3.4, 4.1, 4.4, 4.5, 5.3, 6.8
Synopsis of Ideas/Proposals/Interests: Vehicle-to-grid, Microgrids, Integration of distributed energy resources into grid ancillary services						
46	Cameron Brooks	President	Tolerable Planet Enterprises	cameron@tolerableplanet.com	(303) 957-7667	
Synopsis of Ideas/Proposals/Interests: 1. Dynamic Pricing - As noted in my remarks last week, I believe that one of the challenges for dynamic pricing proposals is that they assume all customers are subject to default dynamic pricing. Other approaches are possible that will capture most of the benefit while avoiding many consumer concerns. Ron Binz has proposed such a scheme in which only the top users are subject to default dynamic pricing. I've attached a recent article. I think it would be great to have a project in Maryland "field test" this approach. 2. Demand Response Markets - I believe that the PJM territory already provides a strong foundation for demand aggregators to access wholesale markets. It may be that this project can serve as a model for other states in which such access is restricted (such as within CAISO and MISO). 3. Data Access - As you know, this is a subject near and dear to my heart. In particular, I think this project could be a venue for advancing the Green Button initiative. The next evolution of this model for data access includes having an automated data feed (versus a one-time download). There are also opportunities to invite computer programmers and software developers to innovate with the data provide. Such "hack-a-thins" have been promoted by the software development community and the White House through the Green Button initiative.						
47	Mark Lively	Consulting Engineer	Utility Economic Engineers	MbeLively@aol.com	(301) 428-3618	
Synopsis of Ideas/Proposals/Interests: The projected growth in distributed generation will require a change in the way that distribution utilities charge for the use of wires. DC's goal of reducing energy consumption by 50% in the next 20 years would nominally require PEPCo's wires charges to double on a $/KWH basis, as I said during the Jan 18 DC Department of Energy All Hands Meeting, even more if much of the remaining consumption is by distributed generation. MD utilities will need to implement distribution congestion pricing as discussed in "Dynamic Pricing: Using Smart Meters to Solve Electric Vehicles Related Distribution Overloads," *Metering International*, Issue 3, 2010.						
48	Allen M. Freifeld	Senior Vice President, Law & Public Policy	Viridity Energy, Inc.	afreifeld@viridityenergy.com	(443) 878-7155	1.2, 3.1, 3.2, 3.4, 4.2, 5.3, 5.4
Synopsis of Ideas/Proposals/Interests: Use demand response by customers in targeted areas to improve reliability of service and defer expensive capital expenditures.						
49	Chris Connor	Director Business Development	Wattlots LLC	cconnor@wattlots.com	(908) 295-5643	1.1, 1.2, 3.1, 3.2, 3.3, 3.4, 4.1, 5.3, 5.4, 6.4, 6.5, 6.6
Synopsis of Ideas/Proposals/Interests: Build smart solar energy systems in existing surface parking lots at critical [congested] grid locations that reduce peak energy demands and provide both power and communications during emergencies. Install LED solar powered smart parking lot, street and traffic lights that can also be used for emergency communications during power outages as well as peak demand power offset.						
50	Paul Alvarez	President	Wired Group	palvarez@wiredgroup.net	(720) 308-2407	5.1, 6.1, 6.2, 6.3
Synopsis of Ideas/Proposals/Interests: Distribution Utility Performance Measurement						
51	Ryan Harty	President	Honda Environmental Business Development Office	ryan_harty@ahm.honda.com	310-783-3962	2.5, 3.3
Synopsis of Ideas/Proposals/Interests: Use electric vehicle batteries to accept surge power from renewable energy, other sources, as means of balancing system; have utilities offer purchase-price incentives to customers in exchange for ability to dispatch surplus power to their vehicle batteries.						
52	Dan Barrett	Partner	Predictive Affects	dan@predictiveaffects.com	540-270-7424	
Synopsis of Ideas/Proposals/Interests: Making the Self-Healing Grid a reality demands a vastly different paradigm for the management of Big Data, and the type of Analytics capabilities for Real-Time Ops Analytics. We are helping several major utilities get their arms around this complex model.						

53	Charles Manto	CEO	Instant Access Networks, LLC	cmanto@stop-EMP.com	410-991-1469	
Synopsis of Ideas/Proposals/Interests: A major consideration for both energy security and related economic viability revolves around the need to deploy far more distributed generation and storage. This can be done with or without participation of utilities and the local power generation and storage can either be off-grid or blended into smart grids. This also makes it possible to address near term threats that could disable power grids for months to over a year... These high-impact threats include cyber attack, extreme solar storms, high-altitude nuke burst EMP, and coordinated physical attack on transformers and large equipment such as generators. These threats are relatively imminent (could happen in days, or months rather than decades as what many believe (possibly mistakenly) the time frame for peak oil or climate change). All local communities and their critical infrastructure should make 20% or so of their own power and be able to store it so that they can reduce peak load costs and demand while making it possible to continue key activities when the regional grids fail. This would be over and above what may be provided by emergency diesel generator back up power.						
54	Itai Karelic	VP Business Development & Sales	Greenlet Technologies	itai@greenlet.net	917-445-1683	2.5, 3.3
Synopsis of Ideas/Proposals/Interests: Greenlet's energy management platform enables utilities and customer to control loads, without the need for professional installation: 1. Deploy the Greenlet platform as part of an integrated micro grid environment. The platform would provide energy management and efficiency for pluggable devices as well as power quality telemetry for voltage management. 2. Install the Greenlet Plug & Play platform in residences for the purpose of energy management & efficiency. The deployment can include individual homes and sub metering for master metered complexes. The program may include a pricing mechanism/ direct load control and remote energy management to maximize customer savings during all hours. In addition the system will enable level 1 EV charging special rate. The lower rate would allow the utility to stagger vehicle charging and manage demand as a distribution resource. Customer opt out is by charging at a higher rate.						
55	Renee Bogle Hughes	Energy & Utilities Practice	Synaptitude Consulting, Inc.	rhughes@synaptitudeconsulting.com	610-812-5718	5.1, 5.2, 5.3
Synopsis of Ideas/Proposals/Interests: Develop an integrated community energy strategy for a specific pilot region. Findings of the strategy may suggest a wide range of recommendations from implementation of a microgrid, targeted energy efficiency initiatives, implementation of renewable and/or distributed generation. The strategy will be developed based upon the unique characteristics of the pilot community. Factors include population density and expected growth, distribution congestion impacts, environmental and geographic attributes that impact the relative feasibility of renewable energies, building types, and regulatory environment. The pilot will be designed and structured after review of similar initiatives that have been conducted both domestically and internationally. The findings of the pilot will include key learnings regarding effective approaches in the development of future integrated energy community strategies, challenges and opportunities, stakeholders, costs and options and recommendations moving forward. At present, there is no "entity" tasked with, and compensated for, performing these high value studies in the US. Decoupled utility distribution companies are well positioned to lead these efforts, creating opportunities new and additional revenue streams.						

Utility 2.0 Pilot Project Discussion Notes

February 1st, 2013

Disclaimer: While extensive, these notes are not verbatim and should not be taken as such.

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Introductions

- **John Jimison, Energy Future Coalition**
- **Dustin Thaler, Energy Future Coalition**
- **Reid Detchon, Energy Future Coalition**
- **Marty Goldenblatt, Sentient Energy**
    - We believe that for the Utility of the Future there's going to be a need to look at distribution network in much finer detail, with much more granularity, and much more detail. A need for sensors to supply that information back to utility
- **John Kelly, Perfect Power Institute**
    - Spent last 7 years researching policy and best practices these types of programs
- **Dallas Burtraw, Resources for the Future**
    - Interested in regulatory structure affecting electricity industry
- **Dan Garvey, PowerRunner**
    - Energy analytics company, we've developed micro-forecasting solutions that are essential to enabling a lot of SmartGrid technologies
- **Paul Frey, BG&E**
    - BG is here to find out what others are thinking and to s hare the concepts we are working on
- **Christopher Burton, BG&E**

- **John Murach, BG&E**
- **Brian Deaver, EPRI**
    - Supports utility industry with research and process improvement and new tech innovation and production
- **Richard Sedano, Regulatory Assistance Project**
    - The form of the utility structure is a core part of the work that we do
- **Allen Freifeld, Viridity Energy**
    - 1) Former member of Maryland Commission so has a real interest in this, 2) company is engaged in load management with wholesale and retail generation
- **Itai Karelic, Greenlet Technologies**
- **Steve Bieber , Metropolitan Washington Council of Governments**
    - Staffs critical infrastructure protection in our region, so very interested in representing interests of utilities, wastewater, telecoms, hospitals, transportation, healthcare, etc. that has large interdependence with electric power
- **Dan Delurey, Association for Demand Response and Smart Grid**
    - Mission is to grow & develop DR and SG from business and policy perspective. Members include utilities, companies, ISOs, etc.
- **Laurie Burnham, Sandia National Lab**
    - One of 17 DOE labs, have a big program area in energy security, aligns with DOE interests. Lots of expertise in microgrids, systems analysis, photovoltaics
- **Todd Hodrinksy, LiteSheet**
    - Semi-conductor devices as related to the SmartGrid and energy conservation programs
- **Steven Lovink**, **Planet 2025 Network**
    - Working on cloud -based artificial intelligence solutions
- **Jim Pierobon, Pierobon & Partners LLC**
    - Works on energy risk, renewable energy, and SG
- **Ross Guttromson, Sandia National Labs**
    - Primarily because we want to find out if we can contribute
- **Bill Gausman, Pepco**
    - Everything impacts us, so we want the opportunity to discuss things that we are doing, trying to make transition for several years now
- **Ray Bourland, Pepco**
- **Chris Connor, WattLots**
    - Developing and implementing parking lot power arbors, currently working with PSEG in new jersey
- **Mark Madden, Alcatel-Lucent**
    - Leading provider of mission critical solutions for utilities, currently working with both PEPCO and BGE, home of bell labs, working with most leading utilities in terms of reliability and scalability, especially Chattanooga
- **Jigar Shah**
    - Partnered with EFC to figure out Utility 2.0 from perspective of a customer

- **Jeff King, Metropolitan Washington Council of Governments**
    - Energy technical committee and energy policy committee
- **Heidi Bishop , Brattle Group**
    - Assisting Peter Fox-Penner who had early insight into this process
- **Renee Hughes , Synaptitude Consulting**
    - Open Geospatial Consortium
- **Larisa Dobriansky, General MicroGrids**
    - As a participant in Smart Grid Demonstration Projects and ARRA-funded development of energy assurance plans, interested in the role of microgrids in improving power system resiliency, as well as in developing best practices and regulatory innovations to support smart grid modernization. Also interested in supporting a constructive role for communities and local governments in partnerships with utilities.
- **Hugh Youngblood, Youngblood Capital Group, LLC**
    - Applying lessons learned to DC Project
- **John Monteleone, LiteSheet**
    - We believe we have the world's best light engine
- **Steve Rosenberger, LiteSheet**
- **Dr. Hervé Mazzocco, Petra Solar**
    - Support with regards to utility owned distributed generation and microgrid
- **Bob Bruninga, U.S. Naval Academy**

<u>On the phone</u>

- **Scott Engstrom, GridX**
    - Software specifically aimed at utility 2.0, we believe that to maximize value of hardware, you need the software and the financial back office, CIS and IT systems
- **Paul Alvarez, WIRED Group**
    - Led teams that have completed comprehensive evaluations of SG deployments, think we can contribute something to the team in terms of performance measurement
- **Sam Gladis, Vilter Manufacturing LLC**
    - Industrial heat pumps
- **Justin Segall, Simple Energy**
    - Motivations that are relevant to customers, engaging consumers on technology they already use. Interested in customer side of the equation
- **Andrew Dietrich, Simple Energy**
- **Kyle Rainey, Xstensible Solutions**
    - SG Integration
- **Craig Lewis, Clean Coalition**
- **Kurt Yeager, Galvin Electricity Initiative**
- **Keren Verch, Ecobee**
- **Everritt Long, Ecobee**

Part 1 – Utility Presentations

For information on this section, please see Appendix A for Pepco and Baltimore Gas & Electric's PowerPoint presentations.

Part 2 – Reliability and Resiliency Enhancements

John Jimison, Energy Future Coalition

We won't take a lot of comments on the utility presentations, we're all very aware that they are looking towards the future. It's been important to hear from them, their most important function is to be here and listen to other ideas and response to those. Going to be organic and iterative to get into the individual issues. We'll start with the reliability and resiliency enhancements, then come back to the biz model. Of course its R&R that came up last summer, comes up more and more in face of changing climate and weather conditions. This is very much in the mind of customers of Maryland utilities. Question is: what could be proposed as an element for a new pilot project that is incremental to what utilities are underway with that could address reliability & resiliency, and can be tested in a discrete utility service area? It must be part of coherent pilot project. We got no proposals that mentioned tree trimming and undergrounding.

One idea that was floated is the notion of microgrid, the notion of having a segregated part of the system that is essentially more self-sufficient to the point of the possibility of being islanded for at least a significant part of a load and its security. We do have a number of people who proposed that one could implement—as part of a pilot project—a microgrid in a given area of utility service area. Hoping that we can get John Kelly to kick off on this topic.

John Kelly, Perfect Power Institute

We could consider microgrids in two different ways. Both a virtual microgrid which would be a section of the utility – which I think is what BG&E described—with target areas and substations and evaluating feeders. And you're looking at deploying on utility side a set of switches and looping that improves reliability locally. And then you demonstrate that with numbers. Then, how do we get the customer engaged in terms of them investing? Microgrids are really about customer investment, and community investment. In a virtual microgrid situation, could you get a community to invest with the utility in planning and thinking about investments? The COG here talked a little bit about how in a virtual microgrid situation, the county or community could be involved with the utility locally to use some of their resources.

From a private microgrid standpoint, that would be finding an area where a larger customer, like a multi-use development, had the ability to work with you to create a physical microgrid where they could island. Maybe go into real-time pricing so they are only islanding when there is an event, when you call on them for DR or ancillary services. Our vision of a microgrid won't go away from grid but will provide value to tenants and grid services. Princeton in New Jersey is the perfect example.

That’s the vision of the private and virtual, two different microgrids. We can expand on that as we go.

John Jimison, Energy Future Coalition
We should make sure to touch on the administrative feasibility of including it in a pilot project. How long does it take, what’s the investment, how would one assure customers of protection against downside risks, etc. After you’ve made a significant investment it’s hard to back away.

Chris Connor, WattLots
One issue with local planning board is condos. We’ve had tremendous number of individual residents wanting emergency power. And in fact, we can’t do that. What we’ve told them is to ask condo associations how they want to hook into emergency power, and then come before us. There are opportunities in condos, perhaps one of them might want to participate.

Allen Freifeld, Viridity Energy
The idea of microgrids make a lot of sense. Familiar with microgrid operations in San Diego. Has a 60 MW load and a 50 MW of resources behind the meter that are 5 to 6 different types of generation. It’s very sophisticated, has the value of islanding when needed, but is integrated into Cal-ISO, buy and sell into the grid when it makes sense to do so. It’s highly efficient, cuts down on cost of making investment because the times you are selling you’re making money.

On reliability aspect, a few years ago tremendous fires in SoCal. PSD with its 60 MW of load was able to island itself and curtail some of its usage and then export some to the grid, so they made money during that period of time and also helped to sustain the grid.

I can see it in Maryland and DC, at University of Maryland, National Institute of Public Health, lots of possible locations for a microgrid.

Larisa Dobriansky, General MicroGrids
I also share the sentiment that this would be valuable. To see how a microgrid pilot would strengthen and interrelate with what utilities are already doing to improve reliability and resiliency. There are excellent candidates in this metropolitan area and within Maryland, including the military bases. Also, good case studies are germinating that could provide suggestions on how to design a microgrid pilot: UCSD, SMUD, Illinois Institute of Technology. You can look around and see what have been the benefits and how that relates to the direction in which you’re traveling in terms of your own modernization efforts. Have a wealth of candidates in your jurisdiction.

Itai Karelic, Greenlet Technologies
We’re involved in microgrid project at VCU, think that’s a great place to start. It’s important to think about two consideration. One is, what would be easier for military bases or university, but it might be easier than condominiums due to amount of decision making involved. Second is, what is it really that we want to test? Do you want to try things that haven’t been tried before such as storage and other futuristic elements? Or do you want to bring together all of the things that have been tried together before into something comprehensive?

Ross Guttromson, Sandia National Lab
Microgrids are very flexible alternative, from that standpoint they don't have to be scary, don't have to have a ton of technologies, you can decide how much technology you want to put in and still get a tremendous amount of benefit. Microgrid is a broad statement, can have very many different techs involved. A lot of military microgrid applications that we've seen, different levels of complexity depending on what's wanted or needed.

Craig Lewis, Clean Coalition
The clean coalition has an initiative that is DG + Intelligent Grid initiative, looking for 5 utilities, Does a quasi-microgrid, in a way that's very straightforward to step into both for utilities and regulatory bodies. Basic objective is to take a single substation on the grid, and when the area served by that substation to get a full 25% of energy consumed from distributed renewables. And to deploy intelligent grid solutions in the form of advanced inverter functionality, tremendous amount of VAR support. Also, demand response. Also, solutions like energy storage and even some pro-active curtailment and forecasting strategies. It's a quasi-microgrid, would not be able to withstand an outage for more than 30 or 60 minutes. Can't stand on its own. 25% of energy served from local renewables is tremendous achievement and will provide resiliency. Starting point is to model grid as it is, add in 25% renewables and then intelligent grid solutions, and then ensure reliability metrics are at least as good as when they started. Already rolling it out in Virgin Islands. Also with IOU in California.

Jigar Shah
Want to make sure that its clear to everyone in the room, the populations we're talking about have very little expectation of reliable power. The reason Berliner is involved in this is because he has 100s of people going to meetings and calling and saying I'm tired of losing power. So the reasons why these microgrids are being discussed is not necessarily to test things but because regulations in Maryland require, for example, nursing homes to have back up power. The vast majority of nursing homes didn't have back up power during the derecho, had people in difficult healthcare situations. Politicians are deeply concerned about.

To be clear, the reason O'Malley is governor is because there as a 72% rate increase 3 months before the election. That's the reason he is the governor, that's why he's led on energy in Maryland. He wants to look pro-active on these issues. I get that military bases are fantastic places to test things, but they are generally not the folks complaining.

Larisa Dobriansky, General MicroGrids
In considering the role of microgrids and how to design a pilot that includes a microgrid, I'd take a look at Maryland's energy assurance plan and Baltimore's local energy assurance plan. The design and structuring should be interrelated with energy requirements examined there and means to assure energy for those requirements, including how to incorporate new technologies within response actions to energy disruptions and major natural disasters in the future.

Renee Bogle Hughes, Synaptitude Consulting
Objectives of what would be accomplished with microgrid, should drive what happens. Not testing

technology, but testing some solution from a customer. Will never get 100% reliability. Some conversation can be around how to enhance communication and enhance first-responders. Important to take into account customer perspective.

Bill Gausman, Pepco

I think it's important to make distinction between campus & community. We have many facilities, universities, hospitals that have microgrid today. That is not a problem, it's a proven activity. The issue is community type programs where you would envision a larger size renewable in community that would serve that community. I have yet to hear an explanation that that kind of environment provides increased reliability, if you're depending on the same wires and distribution system. Yes, we can add the switch and faster restoration, but if distribution systems are going to be destroyed from a storm, I don't care what the source of the generation is, you're not going to be able to distribute.

If you have DG located near individual customers, then you get into issue of how do you aggregate it, how do you operate them. It's difficult to talk in general terms of microgrid and other DG, it requires you to get down to actual designs.

Clearly, talking about a true microgrid will have storage capabilities, at that point cost must be considered. Starts to become a very expensive scenario. I caution people to make sure that whatever pilot is proposed its clearly defined as to what the scenario and environments are to understand the full impact.

John Murach, BG&E

A lot of what Bill said we hear and echo. Campus, hospitals, military, larger manufacturers, already have some type of grid structure built into their systems. We've provide multiple feeds to them. So, MICROGRID is a good topic, but it's not new, a lot is out there.

To the point around who are the constituents, our approach is to look at the broader masses. How do you bring the system back? Bill made a good point, if the system is damaged & destroyed, you're not going to bring that back. But how can you bring as much as you can as quickly as you can back and focus restoration on smaller areas. That would be helpful.

I do think there's a third point: customer engagement. The level of communication, the call to prepare, has gotten so much stronger. We need whatever helping hand for the customer side. Maybe 8 hours of fuel isn't enough anymore, maybe it's 12.

John Jimison, Energy Future Coalition

To the extent we propose to include a microgrid element of a pilot project, we want to distinguish that from the microgrid that are already working. Want to look at potential microgrids that would involve customer side generation with reliability characteristics.

Mark Madden, Alcatel-Lucent

Take these comments based on what I've seen. The interest around microgrid is great, lot of media attention. See it as a great tech for managing instability of renewables, but it's almost useless in terms of managing grid reliability. If the infra is gone, doesn't matter what your source is.

Chattanooga lost 12,144 customers during Derechos. Lost 3 substations. Within 10 seconds 2 of those 3 were back online. Within 2 minutes all the customers were back online. It all had to do with sectionalizing the grid. Put out 120 "intellirupters," all sensor equipment necessary to determine outages. Took level of interruption from days down to 2 minutes. If you want to address reliability, it is all about sectionalizing grid, providing communications to manage sensors, and devices necessary to reduce size of faults.

Ray Bourland, Pepco
In our view it is known technology. Anyone involved in MD Task Force, Pepco's system is different than BG&E's. A lot of equipment that would work for BGE would not work for Pepco. New innovations, now installing it where we couldn't before.

Brian Deaver, EPRI
Tremendous amount of discussion on new applications of traditional reliability management. Undergrounding, etc. EPRI has embarked on large scale research initiative to look at traditional management such as: resiliency of overhead structures--hardening them or making them fail in ways that are easily restored—or looking at undergrounding where it makes sense. Are there ways to enhance automatic switching to provide longer durations or redundant communication paths, or what are the right approaches to turning them off? A lot of opportunity for resiliency activities beyond looking at just the microgrid.

Chris Connor, Watt Lots
WattLots works with PSEG to target renewable power when and where you need it. Can look at some areas that could use half a megawatt or a megawatt of power. Can put them in parking lots. We see need for small amounts of DG throughout the network.

Larisa Dobriansky, General MicroGrids,
Case studies are helpful, but imply that you need changes in the architecture of utility distribution systems to operate with microgrid systems in integrating demand-side and distributed energy resources into utility operations, the grid and the market. Looking at that would help you when looking at when distribution systems go down. Don't just look at microgrids from standpoint of generation sources, but also in terms of creating local energy network infrastructure for more optimum management of overall energy requirements, increasing energy availability across a larger variety of energy sources, and contributing to the control and management of reliability at the local level.

Kurt Yeager
Emphasize that comprehensively putting various dimensions together into transformation of distribution system is the key to intelligent power system. I would underscore that it is above all it is transforming the grid from analog mechanically controlled system to one which is truly electronically controlled from supply to end-use with no barrier between user and utility (meters are barriers, not enablers). DG is important, but only one dimension of putting system together intelligently.

Benefits are almost immediately a multiple of the cost. No reason why stockholders or customers should be penalized financially by enabling these transformations. Done wisely they will immediately produce multiple of the cost in benefits. Not just energy savings and reliability, but in job opportunities.

Ray Bourland, Pepco
Undergrounding – informational point – Pepco has been undertaking a major study of undergrounding, what costs might be. Study is completed, available online on MPSC website. Use case search on home page, case number 9311.

John Jimison, Energy Future Coalition
I take away that the microgrid is of great interest, but need to define what we would test in a way that gets beyond what's already widely operating, going in the direction of: Is a microgrid for a condo or neighborhood a feasibility? As was said, if wires go down, it doesn't matter what power source is. So on re-sectionalizing and re-closing systems, what is particular architecture of a system that makes it more or less capable of benefiting from that? Is there a way to get around barriers to benefits for sectionalizing?

Part 3 – Business Model Modifications

John Jimison, Energy Future Coalition
It's very clear that there's a lot of investment that needs to be made as the utility evolves on both sides of the meter. The utility has to have an expectation that it will recover a return on their investment so they can continue to attract capital and compete in a private economy. Fundamental question: what do we pay utilities for now? What will be paying them for in the future? And will we be paying them enough to maintain and develop?

Reid Detchon, Energy Future Coalition
John outlined direct question clearly. The 30,000 foot question is how can we do a better job of aligning utility incentives with consumer benefit? Can we motivate through legitimate incentive processes activities that will yield better consumer satisfaction in a variety of areas? How are utilities supposed to make money in the new world that matches with what consumers want.

It's a challenge to think about how to test that in a pilot situation, so we would invite comment about how to think about that.

Allen Freifeld, Viridity Energy
The suggestion I'll make involves a change in the mode of operation of utility. As I listened to the utilities speak they've made a lot of investments in advanced tech, and I can see ways for optimizing those investments that have already been made by interacting with the wholesale market. In other words, those resources already investments can provide a service to the wholesale market that the wholesale market will pay for. The utilities could not only be selling their customers power, but also could be selling upstream. It's easy to measure success because there would be a check coming from PJM, which

would be appropriately shared between the utilities, investors, and ratepayers. What I'm suggesting is a true efficiency gain, if you take these resources and optimize their use it's a true efficiency gain that is measurable by revenue (which can be shared). Essentially, making better use of investments. This is very testable.

John Jimison, Energy Future Coalition
How would one test that in a limited sub-area?

Allen Freifeld, Viridity Energy
Concrete example: PEPCO deployed 168,000 direct load control meters for residential air conditioners. That tech is only used in PJM's capacity market. That capability of those customers gets a capacity check from PJM deployed about 5 times a year. If you were to deploy that capability periodically for 10 minutes as an energy resource into PJMs market—not just as a capacity resource but as an energy resource—you would get a check that could be shared between everyone. There's no further investments there. Just a change in operation. Could be measured. Could choose 5,000 of those 168,000 to make it a smaller scale.

John Kelly, Perfect Power Institute
In a pilot, piloting those types of rate schemes with shared savings, you can also pilot new riders. Like Rider LGC in Illinois enables communities to invest to charge and pay the utilities for additional switches. That's actually been used quite a bit, especially for underground. Whole idea is getting more revenue to the utility to produce outcomes that matter to the customer can be tested in several different riders.

Rich Sedano, Regulatory Assistance Project
Happy to hear about use of reliability metrics connected to utility financial performance in PEPCO's presentation. Can go further than that and engage with customers and ask them what matters to them that utilities do that can be measured. That could include reliability, of course, but also customer service, performance, or anything else that might come up in customer engagement process.

Connecting to a pilot, this entire list of topics is hard to think about in isolation. As technology-driven pilots intended to create customer service territory benefits are deployed you measure those and connect them back to performance. A matter of integration here.

Think about utility role in all of this. Usually the utility plays an intermediary role with technology, but now it's role is to bring out the best performers, and get best value for all. It can inspire a pilot.

Finally, a need to think about customer motivations and behavior here, that I would hope in a pilot would lead to intensive awareness of what customers are thinking, and bringing that back into it. That's not always the utilities best thing, to think about what customers are thinking all the time. Imperative to design this into the pilot.

Renee Bogle Hughes, Synaptitude Consulting
In other environments, someone is taking on the role of energy planning. In Canada, Quest has an initiative underway, to pull together a framework for integrated community energy planning. It's part of

that framework to pull out those interoperability standards that could benefit the industry at large. For instance, in Germany they did a study using interoperability standards to look at building types, usage, all the way down to different generation options in different locations. Right now it doesn't seem like utilities are incented to help with community energy planning. In Canada, driven by Quest. In EU, it's government driven. My recommendation would be a parallel effort that leverages collaborative work of Open Geospatial Utilities group. At the end of the day, to incent utilities, if they are rewarding for managing the pipe of the distribution system, that would benefit all shareholders.

Larisa Dobriansky, General MicroGrids
It would be interesting to examine community scale models for advancing integrated energy systems and to interrelate these models with the development of utility models for energy integrated systems.. One big illustration, Viridity/UCSD pilot was part of California's RESCO program, the purpose of which was to address resiliency, energy surety and assist communities in planning & piloting more integrated approaches to developing local renewables. This pilot gave rise to better relationships between communities and utilities. They worked together to understand each other's processes. With centralized planning, that relationship isn't driven. There has to be a better understanding of one another's processes, interrelating interests of communities with interests of utilities to forge more integrated energy systems approaches within dynamic communities.

Paul Alvarez, WIRED Group
You can make a pilot out of performance measurement. Can answer questions like: what are the right measures? You talk about reliability, efficiency, outage information services, extent to which grid enables economically efficient markets, those are all valid measures. How do you define those? How do you measure? How do you moderate them? I think there are potential pilots here.

Broader issue is the risk aversion that utilities naturally have. Comes from limitation on rates of return. What prompts innovation is opportunity for economic gain, I would argue that that doesn't necessarily exist. How do you incent innovation and R&D and reward utilities for those efforts? I think that's a missing piece.

We talked about de-coupling, that's a removal of a dis-incentive, that's good. But we need to do more. Need to figure out better performance evaluation.

Chris Connor, Wattlots
One issue we dealt with in NJ is because of separation of distribution and generation. In order to have distribution company figure out where they want to put generation facilities, there needs to be an authorization for ownership. Recently legislation passed in state of NJ that encourages companies to, under certain circumstances, own facilities. I think that's one of the areas that you need to look at. Can you make changes to basic regulations that allow distribution companies, when necessary, to have facilities in certain areas. We, obviously, think of parking lots. We think this would give utility more capabilities and they can incorporate it into part of their network and have it directly under their management. Would be a major advantage.

Brian Deaver, EPRI
One other aspect when you talk about utility economics and business modeling and reliability, there's a missing connection between societal cost of reliability to outages, and investments that utilities are allowed to make, that buffer is the regulatory structure. There's not a direct connection between the level of economic pain that outages may cause and the investments that are made to address those. Some sort of restructuring that strengthens that tie that allows investments that commensurate with that level of pain is something we want to study and look towards changing in the future.

Craig Lewis, Clean Coalition
One of the policy innovations that Clean Coalition has been working for years is to give the utilities the ability to pay for the investments in the distribution grid upgrades that are associated with wholesale distributed generation projects coming online. The way rules currently work is that for transmission interconnected generation projects the cost of transmission grid upgrades are socialized. On the distribution grid the rules are different. The developer has to pay for upgrades and will never get reimbursed, which means utility does not have an opportunity for that capital expenditure. Clean Coalition has been working to change that treatment, such that the utility is equally motivated to make upgrades in distribution as they are to making upgrades in transmission. This is a critical change that will drive mindset of utilities.

This extends all the way to intelligent grid pieces of the puzzle, storage, advanced inverter functionalities, etc. Those inverters could be owned by utility. Tremendous opportunity for IOUs to get involved in cap ex of intelligent grid game. At the end of the day, utilities have to have a profit opportunity in this game to be motivated to come along.

Dr. Hervé Mazzocco, Petra Solar
When talking about business model and how the utility can recover costs. We are working with microgrids, and I think what needs to be emphasized is that what we are promoting is *intelligent* microgrids. Microgrids has already been done, but we can make them smarter and combining different technologies. Opportunity to recover investment costs playing in the markets. For example, when we're talking about building intelligent emergency power centers for when there are outages that last a lot longer and fuel is hard to come across, people can go to the centers and charge their cellphones. It is only used maybe only once a year for an extreme event, but the rest of the year you can play in the frequency regulation market and then recover some of the costs and some of that investment.

Renee Bogle Hughes, Synaptitude Consulting
There's an opportunity around emergency center response and restoration. Right now, restoration efforts become very manual and not automated. Not a lot of interoperability. If utilities should be incented to implement technologies to enable more open sharing of information, such as locating outages, because utilities do drive responses. We should drive them to digitization to better the community.

Ross Guttromson, Sandia National Lab
I'm not super familiar with Maryland, but a lot of utilities have SADIE metrics and typically they are

normalized with regards to weather. We use the words reliability & resilience; I'd like to bring up a small distinction. One of the things missing from "reliability" is the issue of threat & consequence, what we don't do an adequate job of is to look at where the threats and odds are, and what the consequences are. As part of a pilot I think, especially with the regulatory aspect, this would be a really great opportunity to nail down what further metrics would be beyond SADIE/SAFIE to include things like threats & consequences.

Rich Sedano, Regulatory Assistance Project
One element is to broaden search for metrics. I think to add of political experience and breaking force to some of the enthusiasm, I think that we want a pilot like this to be good news. If it has a perception of throwing money at the utility, that's going to be a problem. One of the implications is that the utility is faced with a choice: some want to take a strong ownership position in various things that happen and deal with limitations, others want to own the things that enable everybody else to do the things they want to do and make their widows and orphans returns on that kind of enabling platform services. In creating this, some trial for where you want to go with that choice is necessary.

One other thought, there's a range of ROEs that come out in rate cases. PUCs have to choose a particular number out of a range of evidence. A utility should have opportunity to earn through that range based on its performance. The opportunity to go beyond that flat ROE, which is the outcome of a lot of economic analysis, is an artifact of regulation that ought to be re-examined. Need more flexibility, maybe by using different metrics.

Jigar Shah
To put a finer point on it, part of the reason I'm interested is many of us see the extraordinarily disruptive nature of Utility 2.0. Those of us that are political scientists of the electric industry, we know how disruptive this has been in Connecticut and New Hampshire. NH's utility company is on the verge of bankruptcy because of Utility 2.0 and because of extreme investments they needed to make in their coal plant to keep it in compliance. The challenge for us is figuring out how this pilot can be structured to provide just that glide path for the utility. In the DC area, many consumers have already voted with their pocketbooks. They spent $20 million on backup generators in the last few years on purpose. How can those costs actually make the utility money? Instead of spending on things outside the utility process.

Larisa Dobriansky, General MicroGrids
We need to look at implications of an "energy internet" that may grow out of smart grid deployment, and how that would affect emerging business models and regulatory innovations. Is it incumbent on utilities to own things/hardware/devices within an energy internet? How would that change the investments? How would that change utility focus? What is the potential impact on market development and innovation of continuing "command and control" approaches?

Paul Alvarez, WIRED Group
Didn't mean to imply there shouldn't be risk associated with reward. The cost-benefit ratio, I'm happy to pay utility an extra point, when I can get two extra points out of improved grid efficiency.

John Jimison, Energy Future Coalition
What I take away is that there are opportunities to identify new metrics that are measurable, communicable, tested that could be utilized to vary utilities risk/reward/revenue situation. May be opportunities for utility investments and services and sales of value to upstream purchasers that could add to revenues and offset what otherwise might be a loss. These are major questions. Voices such as consumer advocates not in the room that would also weigh in on these issues.

Ray Bourland, Pepco
Maryland is a restructured state, and right now utility ownership of generation is not in the cards. As part of Maryland's restructured format the utilities also do not procure RECs from renewable facilities nor do they buy energy from those facilities. Not saying that can't be changed. Right now though that is set forth in statute. Some major work would have to be done to facilitate some things people are talking about.

On monetizing products that grid might be able to produce: right now that's taken a fairly stringent form. The best example is in the Smart Grid authorization that PEPCO and BGE got. They were allowed to make regulatory assets, and recovery under those assets is very much dependent on utilities ability to produce savings. Whether or not we make those savings is not up to us. We can provide the platform, but we can't control customer behaviors. We'll see how much people conform their electricity use to things like critical peak pricing. With that kind of uncertainty, saying we can monetize stream of services provided by platform, there's a lot of risk associated with that.

As far as Maryland being de-regulated, PEPCO is agnostic on that. We've sold all our generation. We think either method would work. If Maryland was re-vertically integrated it would make a lot of things we've talked about today more feasible.

A lot of the discussion today has an implication that not all customers pay the same price. That's not insurmountable, but is a policy decision of a fairly large magnitude. As far as doing things like the relatively small step that PEPCO has taken to agree to increase reliability standards and to put money where our mouth is. If we were to exceed those standards we would receive a small award, if we fall short we receive a small penalty. We have a PSC that hasn't been interested in tracking mechanisms that make this a lot more feasible, even though normal prudency reviews are in fact part of our proposal. Even with those protections, our customer groups say we don't think this is a good idea. If they won't go for it on a first-step pilot basis, we don't know if they would go for something larger.

Chris Burton, BG&E
Agree with Ray. I would point out that we've run pilots assessing consumer behavior on price signals that we do get energy and capacity benefits into the market. Those benefits are being made to the consumers that will be paid directly to consumers that participate and offset cost of smart metering

program. While I do think selling those types of products into a wholesale market provides an extra revenue source, currently that source is being used to go back to the consumers and drive their benefits as well as offset cost of smart metering.

I do think that many utilities are driving the smart meter energy information to consumers which will provide the platform to get additional information to help consumers make choices, both in terms of usage and outages. Will allow us to derive operational benefits that will manifest in more consumer control. We've tried calling consumers before an event and following up after, but they've yet to digest into business processes. I don't know that there's any utility out there that knows how that's going to occur. Working with consumers to see what we can do to drive overall benefits.

Reid Detchon, Energy Future Coalition
Have to recognize that we have challenge the utilities to think creatively about what they could bring technologically. It's also a two-way challenge, we have to challenge regulators and consumer public to think differently. That's the advantage of a pilot, that we can do that in a contained enough way that people will recognize that there may be some downside risks, but they can be contained, and if we can demonstrate benefits we'll have a pathway forward to broader application. To the utilities I would say, we want to work with you in thinking of how to put the question as persuasively as possible to overcome the past experience which you accurately describe.

Parts 4 & 5 – New technology applications/Customer relationship & communication changes

John Jimison, Energy Future Coalition
Lots of new technologies, very broad topic with lots of potential pieces. Basic question is what does it make sense to test as an element of a pilot? It needs to be on the shelf. Not looking to do R&D. Needs to be able to integrate with other elements of the pilot. Not something we already know the answer to. How does a new technology fit in the market? At some point we'll get the Department of Energy matching grant & demonstration smart grid projects that were funded through stimulus bill, there will be significant lessons emerging from that. Want to find incremental, valuable things to propose to the Governor.

Todd Hodrinksy, LiteSheet
Our focus is on elimination of components, working with NY Transit right now, preparing to unleash the most efficient lighting system in the world. WE believe that the grid also, it's about the appliance side. How many components can you reduce & eliminate from a design to increase the efficiency of a design. Running about 4 times more efficient than any system right now, so we're really excited. But again, it's not just about the lighting, it's the whole package. It's the components tied to the grid that could really impact these microgrids that everyone's talking about.

Itai Karelic, Greenlet Technologies
If you want something off the shelf, it means to some extent it has been tested elsewhere. Going to be difficult to find that company that has just launched a commercial product/application but has not tested it before.

Greenlet Technologies has a demand response platform that does not require professional installation. Went for pluggable appliances, it's a plug-and-play, which means you plug it into a surge protector and everything else is automated. Never have to open our computer or portal. You don't need anything, you just plug in your appliances to our surge protector and we oversee management of them.

We've had some pilots in the U.S. with interest from local utilities. We're changing the way business model is done. No need to send a truck to install anything. Just send a box, have them plug it in, and then you're getting real data. Getting real telemetry on what they are doing. Change in the way you approach the customer, a cost reduction in the way you are managing energy. Then there's a change in technology…demand response has been focused on large consumers, but there's billions of KW in residential too. Last part is customer relationship, we communicate very effectively with customers. You can either have minor communications for those not interested, or a lot of information for those who want it. It is democratizing information.

Reid Detchon, Energy Future Coalition
Do you think your product is attractive in current rate structure? Or do you need dynamic pricing?

Itai Karelic, Greenlet Technologies
Either one. Some areas are constrained in PJM, so already there you have a good amount of money to enjoy. There's enough money out there to be able to provide a good ROI to utility, good incentive to consumer, and of course we make money as well.

John Jimison, Energy Future Coalition
Who would buy the units?

Itai Karelic, Greenlet Technologies
This is a utility based system. This isn't for you as a consumer that wants to do efficiency improvements because you don't reap the demand response benefits and you can't really automate as much. But there are very few customers who would want to be that hands-on. If we talk mass market, it has to be central from the utility. It's the same concept as central load control but for pluggable appliances. I would see the system being sent out to the consumers, paid for by the utility or a rate-case, and the money generated from capacity and wholesale markets and energy efficiency credits.

John Jimison, Energy Future Coalition
Communication medium? Wi-Fi? Broadband?

Itai Karelic, Greenlet Technologies
We are agnostic to that. Right now we use Zigby, but it's whatever the utility wants. It depends on the application.

John Jimison, Energy Future Coalition
Move back to LiteSheet guys. You see a way of using application and integrating it with a utility?

Todd Hodrinksy, LiteSheet
With NY Transit, we are working on rail-line related issues. There have been a lot of failures in their rail lines, grid-related with Sandy and the outages. Looking at alternative ways of monitoring lighting systems and having them be self-controlled, almost a micro-electricity system in itself. We've been testing and provided them with samples that they are evaluating right now. We're open to the idea of working with other companies with monitoring capabilities that would tie in to lighting systems, not just on/off. Ours is a semi-conductor array that rides directly in the line voltage, so there are no components in-between, and by doing that we've increased the efficiency of the designs astronomically.

It's a combination of partnering with some folks that have other technologies with Wi-Fi, remote access, phones applications, etc.

John Jimison, Energy Future Coalition
Itai, I take your point about balance between newness and commercial availability. You want to test and display something that's new, but also something that—if the pilot works—you're ready to roll it out on a broader basis. You want to minimize risk on a pilot that you're testing something that simply may not work.

Dr. Hervé Mazzocco, Petra Solar
The technology that we've developed is basically a utility grade micro-inverter. The reason why we came to this is, we thought about how can we make deploying PV simpler; and how can we do less harm and also do some good? The more PV and renewables and intermittent sources you put on the grid you create instabilities. We looked at how we can mitigate the high=penetration issues. We came up with a micro-inverter that allows us to create a highly distributed virtual power plant. In the NJ PSEG deployment, using the existing assets, we mount PV modules with the micro-inverter on the poles and inject directly into the distribution.

The other aspect was to look at how we can add features to those micro-inverters to mitigate negative effects of high penetration of renewables. And that includes dynamic volt/var and other features that we can pack into a micro-inverter. That gives us a lot of flexibility. We added to that a communications architecture that's very important in how we get to Utility 2.0, which is very important. So now each and every one of these micro-inverters are able to sense what's going on in that distribution circuit and gather data through wireless networks. You can gather all that information at a network operating center.

This is the base of what we've created, we're leveraging these techs that have been developed to look at how we can affect other aspects. Lighting is one, how do you use this distributed PV and this communications infrastructure to manage public lighting, for example? Next step is how can we communicate with the utility management system? How do you use those communications ability to reach the market and play, for example, in the frequency markets?

Allen Freifeld, Viridity Energy
I'd like to suggest customer load management as a distribution resource. Targeted geographic load management to a stressed feeder or stressed substation. It would defer cap ex and complement the various distribution technology upgrades that those utilities spoke of earlier. The test would be that the load management would be considerably cheaper than the capital expenditure. They are doing this now with ConEd, proving that it is not pie in the sky. What we do is sit between the end user and ConEd distribution and provide communications so that if ConEd has a distribution event, it gives ConEd real-time insight of what's going behind the meter with particular customers. Linking the customer to the distribution is really appealing, and I could see portions of Baltimore and DC doing this.

Mark Madden, Alcatel-Lucent
Fundamentally, we're the plumbers. What we were proposing was a cloud-based computing infrastructure that would allow for secure control and highly scalable distribution of the application assets getting data where it needs to be, reducing strain on comms infrastructure. It would also allow for other applications such as microgrids to be cost-effectively deployed. It would allow for islanding, too. Have all computing capability necessary for the grid to act as an island, but then acts as an integrated whole when the power grid comes back online. Fundamentally, I'm talking about the foundation as opposed to the application.

One major challenge facing BG&E and Pepco is the availability of spectrum in order to get access to the various sensors and such. I am trying to establish public-private partnerships between utilities, critical infrastructure, and public safety community who often share public safety issues in a disaster environment. The technology that has been chosen for that has ability to differentiate and secure multi-tenants. So utility could ride on same network that state police are riding on and share that infrastructure. Under that circumstance, we could prioritize so that the public safety community can use it at the same time as the utility without either entity ever being denied access.

John Jimison, Energy Future Coalition
On the shared communications network, I'm one of those people who believes that the utilities *are* a public safety service and they require the same kind of priority of communications bandwith. I take it though that the technical case still must be made that this can be done?

Mark Madden, Alcatel-Lucent
That's correct. We've been experimenting with this, but putting it in a pilot would be a proof point.

Chris Connor, WattLots
WattLots uses already adopted and in-use technology, but we are leading edge in design. We essentially designed an element we call the PowerArbor and the Lightbeam. The Lightbeam is unique in that it has micro-inverters and is a 1 by 18 collector, which allows us to do a number of things. It'll do the things that Hervé talked about, because we have comms capabilities there. We also produce AC electricity at the collector, that allows us to have low voltage. In addition, the Lightbeam and PowerArbor have been used and have installations in place. Also have under test a power pole with same technologies. The comms ability gives us distinct advantage. We've looked at plug-in-play applications. One of them is

power capability for electric vehicle sources. We've also looked at putting displays for marketing and public service announcements. We've looked at how it can improve emergency situations. These products are working or are in development, we think it would work quite nicely with the things Maryland is looking at. But we're not in the management business, so we would need, for example, PetraSolar for that.

Larisa Dobriansky, General MicroGrids
I would emphasize the need to look at the architecture that needs to be developed within distribution systems in order to combine and configure smart grid technologies and infrastructure to support the orderly integration into utility distribution management systems, the grid and the market of distributed resources -- technologies, devices, and systems. . I would recommend utilities take a look at the kind of reference design documents and architecture that EPRI has advanced in terms of its Smart Grid demonstration initiative that is being incorporated into a lot of the game-changing pilots funded by ARRA money. EPRI is trying to encourage integrative technology and architecture that will allow utilities to use smart grid technologies to capture more fully the benefits of efficiency, electric vehicles and an array of distributed energy resources. . Such architecture will allow utilities to be able to get the fullest benefit from smart grid technologies in terms of improving visibility, enhancing forecasting with significantly more granularity, achieving interoperability and intelligence with respect to distributed resources, applications, devices, and systems.

John Jimison, Energy Future Coalition
Larisa, what information should expect coming back from the ARRA grant projects?

Larisa Dobriansky, General MicroGrids
There are already lessons emerging. Some will be completed within 2013, more within 2014. EPRI has its own clearinghouse of information, DOE also has a clearinghouse of information. The individual utilities and non-utilities that are players have been forthcoming in talking about what they're doing, we can probably go to them directly and ask.

Renee Bogle Hughes, Synaptitude Consulting
Comment on going towards a cloud-based environment: from a general trend & technology perspective, that's where it is headed. However, if you look at its potential application to utilities, it's a disincentive to IOUs because of the capitalization. There might be quite the business case to go with software as a service, to drive to one single point of information for interval data, utilities are compensated by a model that says you're asset-driven, you're going to be funded based on your asset base. So this would require a fundamental shift, moving moreso towards a market where money is money versus only capital being put into our case. Cloud is definitely the trend of the future and something that should be considered.

Mark Madden, Alcatel-Lucent
I'm not disagreeing, but what I was referring to was a private-cloud network as opposed to public, so it would be a capitalized expense. Each utility would own its own private cloud, or a conglomeration of utilities would own a cloud. At the end of the day though, it has to be secured.

Renee Bogle Hughes, Synaptitude Consulting
I agree the cloud needs to be secure, but when you look at each utility potentially owning assets that are the cloud, then it goes back to the asset model. There is a real dis-incentive to consider these trends in the broader technology world.

Martin Goldenblatt, Sentient
We make sensors that go in distribution line that measure current & temperature. We looked at network and found that about 85% of outages occur on distribution side, not on transmission side. Yet there seems to be a real lack of knowledge there. We came up with our own sensor, no wires to connect, it reads the energy going across the wires. It can help us learn where outages are, where they are likely occur, and help us get the people out there to fix it. If we see momentary faults, we can capture that waveform and identify it in our library of waveforms, and we can figure out what caused that momentary fault. For example, there are waveforms for tree branch interference. If we see one of those, a team can be sent out to fix it. It can be used for demand response verification, too. We've identified 15 different business applications that these sensors could address within the context of the utility. You can use one central sensor, if you will, to verify the other multiple applications and get more bang for your buck.

John Jimison, Energy Future Coalition
Smart meters do give you those responses to an individual customer application, but I take it that it may be valuable to get outage waveforms from the wires themselves.

John Kelly, Perfect Power Institute
The web, mobile business, and software are all converging now to enable things that were not possible a little while ago. You take that and combine it with this new market…Honeywell was installing security services for free, with the customer doing nothing. It's all integrated and very intelligent. Some companies, not only on the security side, but on the entertainment side are getting involved in this, they will come in and automate your home and will usually pay for all the capital upfront. Sony, Samsung are paying an awful lot of money to "own the home."

We've just touched the surface in terms of lighting right now, especially in the fluorescent area. They make yellow fluorescents now. I have them in my house now, and through utility rebates they were nothing.

We're looking at these new business models, with the new technologies and the distributed generation and the automation and the solar we've talked about, we have companies in Illinois that give you a gas generator, pay for it up-front, take you into real time pricing, and the unit hedges your real time pricing. I don't have to worry about getting caught in a high-price zone.

Pecan Street did something unique, they went out for a bid with a well-defined pilot. You could probably get the RFPs from Pecan Street. They selected 300 homes and had companies bid on the ability to go in there and be part of it, and they got some big big players. 2-3 years later the envelope is wide open.

Itai Karelic, Greenlet Technologies
We have to remember that Pecan Street got $50 million from DOE. I was involved in the RFP. Sony wanted complete automation for $500. Brewster said yes, Sony can do that, but smaller start-ups can't. So I'm not saying that there aren't great lessons there, but it was easier for Brewster to do all this because he had DOE money. It wasn't something that the smaller and more innovative companies could finance. Some of the things in their model didn't necessarily foster innovation.

John Jimison, Energy Future Coalition
So that actually implicates the question of finance, and how to overcome some hurdles that a smaller start-up might face of not being able to participate in a pilot due to financing.

Itai Karelic, Greenlet Technologies
As long as we're included in the rate case, then it's fine. There's a very clear question: can we meet the rate case? If we're compared to another central AC load provider (for example), then that's fine, I know what I'm facing. It's something else when everybody else is included in the RFP and Sony doesn't mind shelling out.

Dan Garvey, PowerRunner
We're an energy analytics company, and we're going to help enable a lot of the tech that the smart grid is going to create for consumers as well as utilities. We're a micro-forecasting and settling application. What we are able to do is forecast and settle every individual account on a sub-hourly basis, down to the minute actually if we have to. We've scaled this for a million accounts. It's installed right now at the NY Power Authority. We use its local parameters (local weather, historical load and usage patterns based on time of day, season, cloud cover, etc) and get very down to the meter on these forecasts. We're able to leverage and forecast this stuff with any parameters that you define. We can, for example, look at all the accounts on a critical circuit and isolate it. All of this becomes available through detailed analytics. If you talked about DG, storage, EVs, all of these programs are going to create havoc with utility systems from a balancing and voltage standpoint. Having visibility into that is going to allow them to more effectively maintain system stability.

Dynamic pricing, if we can forecast each individual meter, we can project to each customer what their forecast is going to be hour by hour on the day ahead. They can look ahead and understand what their day ahead pricing is going to be and their load at specific hours.

Locational resource planning is another thing, utilities want to understand what is happening from a volt/load perspective, and want to be able to model additions to their system and their effect on their substations. I see us as that enabling application that can create a lot of value and metrics for a pilot.

John Jimison, Energy Future Coalition
What is the communication mode that your devices would use to send the data?

Dan Garvey, PowerRunner
We pull data out of the CIS, so as quickly as it can be put into a CIS we then interface with that. Doesn't matter the platform. We are sitting on the utilities side of the house.

John Jimison, Energy Future Coalition
How does it scale?

Dan Garvey, PowerRunner
In the pilot program we would simply identify how many accounts you'd want to do it for and link those accounts to the system, there's some integration costs associated with that. There's scale lost there, but we're willing to go into this as a pilot to demonstrate how it works.

Reid Detchon, Energy Future Coalition
If I understand correctly, you're using the weather data as a proxy for what the price will be? Could it integrate into the market directly?

Dan Garvey, PowerRunner
It can, but what they are trying to do is look at the weather on an individual account basis to understand what that load is going to do. We can project prices, but we feel our primary objective is to understand what the loads going to be because that's going to affect the market.

Keren Verch, Ecobee/Everitt Long, Ecobee
We provide a line of smart thermostats that support both smart meter integration and handle demand response through smart meter or internet. We offer additional consumer based motivational behavior changes, too. Because our device is popular to use, we achieve much higher rates of energy savings due to higher numbers of consumers using thermostat programs. We have adaptive setbacks which provide greater comfort. We also provide an energy modeling portal so consumers can see how much they are saving versus other people in the neighborhood, all of which motivates energy saving behavior. As a solution it's quite inexpensive. Probably causing savings of 21-26% of energy cost versus what they had before. We have several pilots right now, can be done quite quickly.

John Jimison, Energy Future Coalition
Obviously there is an array of new technologies, the key for a pilot project is what do you select to offer in the pilot area? Who makes the decision as to whether or not to deploy it? Who pays for it? How do you determine the results? As with the other topics, the floor remains open on these issues.

Renee Bogle Hughes, Synaptitude Consulting
The key here is to say: what is the customer benefit, and what are the technologies we are going to leverage to provide that benefit? It's not the implementation of the technology, but the actual business processes that sometimes aren't necessarily justified with a big capital investment up front? It's not implementing technology, but how you use it.

Andrew Dietrich, Simple Energy
We're a customer engagement platform, we deliver motivational messaging with technology that consumers are familiar with…via web portal, via mobile application, via e-mail and print, and also integrated into social media. Reid & Renee both hit on this, but we need to figure out what that value is and how to create more value than simply pushing more data towards the consumer. So we believe in

targeted motivational messaging, creating insights around energy usage and also social context around your energy use such as through community competitions. You can actually get rewarded and get feedback. This creates a better customer satisfaction and to the utility creates better data and customer segmentation that ultimately delivers kWh of energy efficiency and of peak load reduction. We see customer engagement as a key piece of this whole thing.

Reid Detchon, Energy Future Coalition
I would encourage anybody here to follow up with us to describe how we might think about integrating some combination of these technologies, how that would affect the consumer and utility experiences. That would be very helpful to us in the design process.

Chris Burton, BG&E
At BG&E, we've been looking at and testing some of these technologies in various phases. We have what I would call a very mature demand response program that, and we've been moving towards individually addressable devices, allowing consumers to opt-out of events, but also allowing us to target and better reduce load in a stressed area. Getting back to regulatory paradigm, we don't get credit in regulatory process for money not spent, but it does allow us to target our capital dollars into areas that do have reliability impacts. That's something we're already doing, has been very successful on the transmission side. Targeting on more local levels is something we're doing now.

In terms of considerations for a pilot, a lot of our programs are already doing some of the consumer engagement elements spoken of. We're already incented to gather as much benefit from consumer behavior changes to drive energy efficiency & demand response in our current programs. We don't get cost recover for smart meters until we show benefits, and the biggest line items are efficiency and capacity. That said, the newer technologies may be able to do it more efficiently, or they may be able to garner more benefits out of assets we've already invested in.

When looking at RF, you need to balance how much you do from a pilot perspective versus considerations for security and privacy. Significant issues. Some customers do not want smart meters because of privacy concerns. Need to recognize that. When we implement a new technology, there is extensive testing first. Need to balance how much you can test in a pilot versus integrating it with the utility which really requires a level of testing and a level of integration that takes a lot of time and cost.

I don't think it's a dis-incentive to move to software as service. I think there is more of an incentive for us to do assets, but when you have limited assets, to the extent you can do something more efficiently on the expense side, and then target your capital to things that improve your reliability, that is where we are headed. We've seen efficiency gain from IT infrastructure, etc. That said, there is little incentive in the current regulatory makeup because R&D is an expense.

Ray Bourland, Pepco
Add that we do have every incentive to control our costs. We're not looking out there looking to increase our asset base to improve our bottom-line to our shareholders. We add assets that are intelligent by design.

Dr. Hervé Mazzocco, Petra Solar

Thinking about the point that it would be great if the different technologies could collaborate, would it be possible to get bullet points about what each of us is proposing and centralize this so that we can have an overview of what people trying to do?

John Jimison, Energy Future Coalition

We can certainly share the names and affiliations of everybody who's been here. We would be very enthusiastic about people combining ideas, and maybe coming back to us with a joint idea about what would make a good pilot element.

Part 6 – Involvement by other stakeholders

John Jimison, Energy Future Coalition

Maryland's utilities are de-coupled, they are not responsible for the energy supply, but that doesn't mean that the generator isn't a key component of the system. It would be conceivable for an energy supplier or marketer to participate as an element of the pilot project, maybe offering a particular advantage to customers who decided to go with that supplier.

We are certainly in interested in including in our pilot is the electric vehicle community. Manufacturers, users, suppliers, people who are proposing ways of integrating and communicating about electric vehicles to the utility. With the hopeful possibility that the battery in EVs might actually have some usefulness back to the utility in a vehicle-to-grid scenario.

Electric storage is another field of immense potential and uncertain current commercial validity. Yes, we have batteries, they're very expensive. If there are storage technologies that are ripe & ready to test, it would be such a game-changer in operations and economics on the system, that it would be terrific to know about it.

Bob Bruninga, Naval Academy

A brief summary of Bob's PowerPoint presentation has been provided by Bob himself, below:

"Bob provided a presentation on many misconceptions about Electric Vehicles based on a century legacy of gas-tank/gas-station thinking. A battery is not a gas tank. You don't drive an EV to empty and then look for a place to recharge. The educated EV owner understands that an EV is a commuting appliance that remains plugged into the grid conveniently while parked at home, and at work (and only occasionally in retail areas she may visit). The present concept of rolling out expensive specialty public charging stations is a legacy of gas-station thinking and is unsustainable as EV's scale to a larger percentage of our 300 million vehicle transportation sector. The true value promise of the EV is achieved when the consumer understands the value of charging-while parked at home and at work and then all the issues of range anxiety and time-to-charge vanish as issues. The vehicle begins every trip fully charged and ready to go.

The Maryland EV Infrastructure Council studies show that 97% of all EV charging-at-work can be met with simple 120 volt charging if vehicles simply remain plugged in at work. Employees are not going to play musical cars every hour in the parking lot to share a few expensive fast chargers. But having rows of EV's plugged in all day to simple 120v outlets has significant potential to the use of even existing load control devices for the benefit of the utility."

John Jimison, Energy Future Coalition
Each of the utilities has had its own work on EVs, and we are interested to your reaction on that; on whether one might emphasize level 1 parking ubiquity within a test pilot area and try to educate the others who live in that pilot area to the notion that any place you go in this area, you're going to be able to plug your car in, all you need to do is figure out is how many incremental miles you're going to need.

Allen Freifeld, Viridity Energy
Storage is a gamechanger. We're seeing a lot of traction with storage added to wind & solar generation. This does a couple of things. It improves the economics of standalone solar & wind by about 20% because it adds optionality. You can consume it in real-time or divert it to storage. You can also sell regulations. The storage firms up wind & solar and can make it into a capacity source.

If you look at a pilot, I think a 500 kW or 1 MW battery would be an ideal size. If you want to combine it with solar/wind you want it located there. It can be at a Walmart parking lot or a basement of a building like this. It's about the size of a tractor trailer. The economics are very good, you simply need a site. The regulation market is an 8,760 hour a year market. The battery charges and discharges and you get paid in both directions. The payback period is about 5 years for a battery with a 12 year life. If you have a reasonable hurdle rate, that's not bad. And, if the battery is financed**,** you are cash flow positive from day one.

Chris Connor, WattLots
The stakeholders we are talking with are battery storage people, EV charging producers, and EV producers. Since we are a parking lot system, keeps at near maximum power until 4 o clock and then starts to lose power (versus non-tracking units that start to lose power shortly after noon). In addition we can extend maximum power for a couple of hours with battery storage and meet the peak power demands that can occur in late afternoons during the summer. We are looking at batteries that give us an extra 2 hours and would take us through 6 o'clock.

On the EV, one of our arbors supports approximately 10 parking spaces. And we'll have the electrical infrastructure there, we don't have to be tied into the grid (but we will be). In an office environment, level 1 with one of our arbors covering 10 spaces will help a lot. In an office situation, they'll be there 8 hours, you don't have to worry about moving them. For a shopping mall, they may be there for 2 hours and you need level 2 charging. It's location specific.

At Rutgers, they are testing solar arbors (not ours), so it might be good to include data from them and talk to the professor in charge about it.

Mark Madden, Alcatel-Lucent

There's been a lot of talk in the industry about using EVs to discharge cars and cut off peaks from the grid, recharging them later. Lifetimes for vehicle batteries are generally measured in number of discharge cycles, and I was wondering about your thoughts on that, in terms of what this does to the life expectancy to the vehicle? To the maintenance of the vehicle and the servicing of the battery?

Bob Bruninga, U.S. Naval Academy
That was a point I wanted to raise. We talk about HVAC and hot water as the main loads in the house, well get ready for it the next one is going to be the EV. Number two is that all of the promise of vehicle-to-grid is only available if the car is plugged in. If you focus on L2 and L3 chargers that charge in one hour, you're not going to have any assets out there to play with. They are going to charge and unplug. We mentioned a 1 MW battery. That's just 40 cars. So in this park-n-ride lot, you make one row, 40 cars long, you invite EVs to plug in, then there's your 1 MW battery.

Mark is absolutely right about the short partial cycles lowering battery life, though. I'm not focused on that. I'm focused on the load side of the vehicle-to-grid. You are correct that there's an emotional thing that needs to be overcome where you are letting the utility take your EV's battery power when they need it. If the utilities can figure out how to make that work, okay it's nice to have both the controlled load and EV battery sourcing. But why don't we target the easy 80% solution and have the load control of that 1 MW battery out there, and use that to draw down our grid surpluses. The EV owner is going to be charging the car anyway to get to and from work so that one charge cycle he is already committed to.

On this demand response aspect, you're not adding a single cycle. If you're pulling it out of the EV battery during times of peak demand, and then plugging it back in, then yes, you're adding cycles and I would agree with the EV owner that it would shorten battery life.

John Murach, BG&E
This has been a topic of intense conversation. First, I want to paint a picture of the market. You spend a year and a half getting EVs to break the market entry barrier, get the first cars out, get some chargers out there. That egg is broken. Now we're into broader implementations. We've seen more models coming. Let's get past the home, let's get to the next level of the pyramid. We're starting to see that.

I do want to direct folks to the Maryland EV Infrastructure Council report, on the Maryland DOT website. It covers this issue in detail. Not quite as easy as putting a sign on every outlet, but it certainly makes charging more available. From a utility perspective, when we look at load control of a large appliance, how do we blend that into our mix and derive value from that?

John Jimison, Energy Future Coalition
Is this an element that is new enough, valuable enough, untested enough that it warrants consideration for a new pilot project? It may well be. We'll have further chance to consider that and I invite further input on that.

Larisa Dobriansky, General MicroGrids
There are good case studies on different ways to design the pilot to look at alternative options and evaluate the effectiveness of them. There are opportunities to look at combinations of technologies and

an array of different types of incentives and how customers respond. And of course, these pilots reflect critical partnerships with key stakeholders. Pecan Street and an array of others give a good idea of how they designed & are evaluating different scenarios and alternative options. For purposes of this proposal, it would be beneficial to examine how the project managers in these case studies are evaluating the cost-effectiveness of alternative technologies and strategies that are being implemented in the pilots.

Part 7 – Pilot Period Issues, Next Steps

John Jimison, Energy Future Coalition
Now into the pilot management issues. One is, how do you designate an area? How do you determine how to segregate the area into piloted and non-piloted? It certainly changes dynamic if you impose upon people. You are constrained to allow an opt-in or an opt-out, but that also changes dynamics. If everybody is a volunteer, that suggest that they are early adopters and you may not get the best measure of a typical consumer.

Other questions: how long it should take to put a pilot together? How long it should run for? Who should be involved? We may even have two different pilots focusing on different elements.

Renee Bogle Hughes, Synaptitude Consulting
I don't know what design is, but the effort and thoughtfulness in actually designing it is going to be critical. The amount of effort in defining the pilot is corollary to the success of the pilot. Also, what is it that you want to measure, because that is going to affect the design of the pilot.

Rich Sedano, Regulatory Assistance Project
Going back to what customers are thinking about, and some of the political overlays of this, if this were a blank slate it might be a different conversation. The MD PSC has been in the middle of debate about opt-in/opt-out. Need to be open to what you hear from stakeholders so that they don't feel that whatever is decided has already been decided before they had a chance to talk about it. A lot of advocates are concerned about opt-out because they don't really view that as a realistic choice, they view that as forcing customers to defend themselves. Be realistic about the fact that you're not starting from square one on something like this. Try to understand experiences that exist already. Instead of thinking of people as obstacles, think of them as resources.

John Murach, BG&E
It would be helpful to digest& decipher the objective of the pilot. As we move this forward, what is that we want out of it? And then filter from that. You've heard two large utilities talk in two words: Smart Grid. The Smart Grid is a comprehensive transformation of how we manage, maintain, and invest in our system and engage our customers. What is new, what is incremental? Or rather than create something new, identify that aspect that is real, that is meaningful, then have a discussion about how could we move that forward.

John Kelly, Perfect Power Institute
Accelerate/validate both utility and customer smart grid investments that produce significant customer and utility value and improvement. This pilot should validate and produces measurable outcome and have this independent pilot committee say yes this is working, you don't have to wait to see that this is working. That's a foundational element of this pilot. From everything I've heard you guys are on this path.

And then when you talk about the community, you could start to build emergency planning capabilities. What you call microgrids we call protecting key facilities. If you could identify in those two piloted areas, what are the key facilities critical to recovery from an event that knocks it all down, those facilities could serve as the test of the micro-grid/islanding services. That key security element that lets us all explore how much the customers can be an asset to the utility.

The third aspect is the residential pilot. The utility would demonstrate greater value of AMI and other customer side investments, and the customers see savings and revenue from participation as well as greater convenience.

And then the fourth thing is how an electric vehicle pilot fits in as a piece. One way you could do EV is to offer free parking for EVs near the front office of every high school. Every parent would go out and buy an EV that month. People covet those spots.

If we all think that a pilot like this is stuff that we've already done, and we're not going to create some new things, then I agree with the utilities that there's nothing new here for you. We would think that this type of pilot, with John's leadership, would lead to innovations and ways to get penetration for the things you want to take care of.

The last thing I'll say is that there are three bins we have to take care of: the utility benefits, customer benefits, and the commission benefits. So I just wrote down these goals:

- SAIDI/SAIFI for the area goes down by some percentage
- *X* MW of DR are deployed
- There's some permanent demand reduction that's measurable
- *X* amount of KWh of conservation deployed
- There's measurable savings, maybe by per-unit price
- Plug-in penetration
- Customer technology adoption level

These are some possible goals.

Ray Bourland, Pepco
It seemed to me that towards the end of the day, we kind of looped around the community-based microgrid type applications and discrete applications (campus, military bases, etc). I think the complications are much less with a campus based application than with a community based application.

At the heart of the community based application, is if you let participants self-select you will get early adopters and their behavior won't mirror society at large. But if you do opt-out, a lot of customers really hate that.

From what we've heard from the utilities, we're working on a lot of the things we've talked about today in various shapes and forms. A pilot program for a company with limited resources like Pepco could lead to—depending on how complicated and encompassing the pilot is—to us having to divert resources from some broader things we're working on in order to test and then deploy throughout the system on a timetable that makes sense from the readiness of the application and from a customer acceptance perspective. As far as I'm concerned, there are plusses and minuses to each. With a pilot you could take all these things and say you're kind of far along on these, why don't we trial them in combination with some other things that we are also kind of far along on, and see how the pilot as a whole holds together. But it will come at a cost to Pepco of slower deployment of some of these things which may already be ready in to the rest of our service territory.

Dr. Hervé Mazzocco, Petra Solar
We also have to be aware of the circumstances that we've had the last couple of years with hurricanes and storms and outages, and that should push us more in one direction more than the other, because that's the main concern from the general public right now. Definitely focusing on this aspect of emergency power and creating some level of comfort for these people who, during a 10 day outage like New Jerseys, may not be able to charge their cell phone or tell their boss what their situation is. Keep that in mind that the general public is thinking about this.

Renee Bogle Hughes, Synaptitude Consulting
To look at a totally non-technological perspective, if you look at the utility business model and what the utilities have now, you have smart grid technologies and you have data. And if you look at the competencies of the utilities, they are reliable, committed, secure economic, safe, and they run restorations. What I'd suggest is leveraging that for the good of all stakeholders to benefit the commission, utility, and customer by providing more information for public services. When you talk about outages and restoration, collaborating on information with entities that are first responders would cause restoration duration to be less. During storm restorations, utilities run the show. Utilities aren't viewed as a service provider, and there's a real gap and real need there.

Larisa Dobriansky, General MicroGrids
One other area that comes to mind in connection with management are the analytical tools and valuation methodologies that will be used to measure performance and cost-effectiveness. We need to think about extending the array of modeling simulation and analytical tools. Think about new ways of valuation. With all these new technologies, we don't yet have the appropriate cost-benefit analytical frameworks to measure the new types of smart grid functionalities and capabilities that we're discussing here. So we need to think about that so we can better capture benefits and costs arising from the project.

Chris Connor, WattLots
Responding to the question on limited funding: we're a small company so we really know what that means. Given current circumstances, there may be available moneys over the next 6 months to a year that might be able to support some of the development of this pilot project.

John Jimison, Energy Future Coalition
Thank you all for coming, and I'd like to end where we started. We all know there is a massive transition coming in this industry and that is going to change not only technology, but also utility practices and consume roles, etc. At the end of that transition, utilities will remain major participants in the economy. We may be using a lot less power, but the power we do use will be much more valuable because of its role in our society. What I've imagined this pilot as is: what combination of measures can we put in place in a pilot area that anticipates and moves us towards that result in a more managed and less chaotic fashion than is otherwise likely to happen, with full cognizance of what's already going on.

From what I've heard from today there are a lot of great technologies, applications and practices that will be a part of the system of the future and the sooner we can understand them better and try them out, the better off we will be.

Don't hesitate to be in touch with us!

APPENDIX A – Utility PowerPoint Presentations

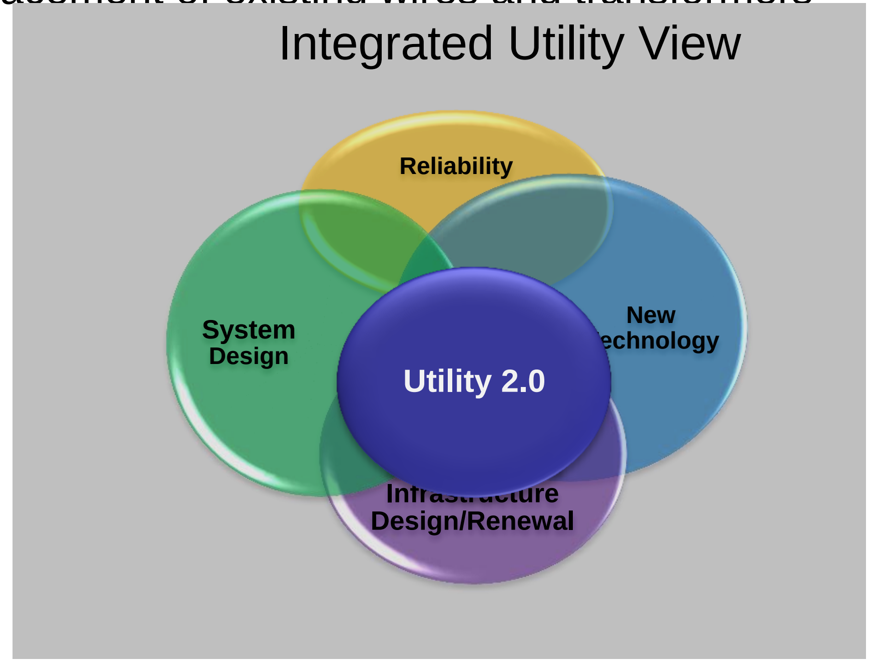
January 2013

Pepco Plans for Continuous Grid Modernization

Pepco Holdings, Inc

Grid Modernization and Utility 2.0

- Bring new advanced meters, sensors, communications equipment, automation and computers to the existing grid to improve customer experience, power quality, reliability and security
- Provide valuable energy information to customers to help them to make choices regarding their energy usage and costs
- Modernize the grid without premature replacement of existing wires and transformers
- Create opportunities for innovation
- Enable advances in load management, customer service, outage detection, service restoration, and system planning
- Facilitate deployment of renewables
- Facilitate microgrid deployment



Utility 2.0 - Focus Areas and Opportunities

People

Workforce of the future

- Cyber Security
- Quantitative Analysts
- Communications Systems Engineers
- Digital Power Systems Engineers
- Linemen of the Future

Process

Regulatory

- Cost Tracker
- Innovative Rate Structures

Business

- Customer Engagement
- HAN
- Apps
- Engaging Demand
- Services

Technology

Big Data

- Advanced Analytics Capabilities

Grid Awareness

- Sensors and Passive DA

Grid Management

- Active DA
- Renewables
- Electric Vehicles
- IVVC

Microgrid / DG

- Solar / Wind
- Fuel Cell
- Hydrogen
- V2G

Pepco Holdings, Inc

Utility 2.0 – Technology View

Puts decision making in the hands of customers

- **Provides information, programs and pricing options to allow customers to make informed energy choices**
- **Provides customers increased information about their energy usage**

Automatically accommodates changing system conditions

- **Fault isolation, automatic restoration, advanced grid sensors**
- **Reroute power flows, improve voltage profiles**
- **Automatic notification of corrective actions and pricing signals**

Enables system operation with greater efficiency

- **Improved asset management by optimizing grid design and investments**
- **Optimization of the grid, reduce losses**
- **Increased reliability and security**

Promotes green energy initiatives and enables participation of intermittent load and generation

- **Electric Vehicles and Vehicle to Grid**
- **Renewable Energy - Solar and Wind**
- **Microgrids**

Provides future flexibility, resiliency and compatibility

- **Adheres to Open Standards**
- **Includes Advanced Cyber Security**
- **Increased Network Operations Monitoring**

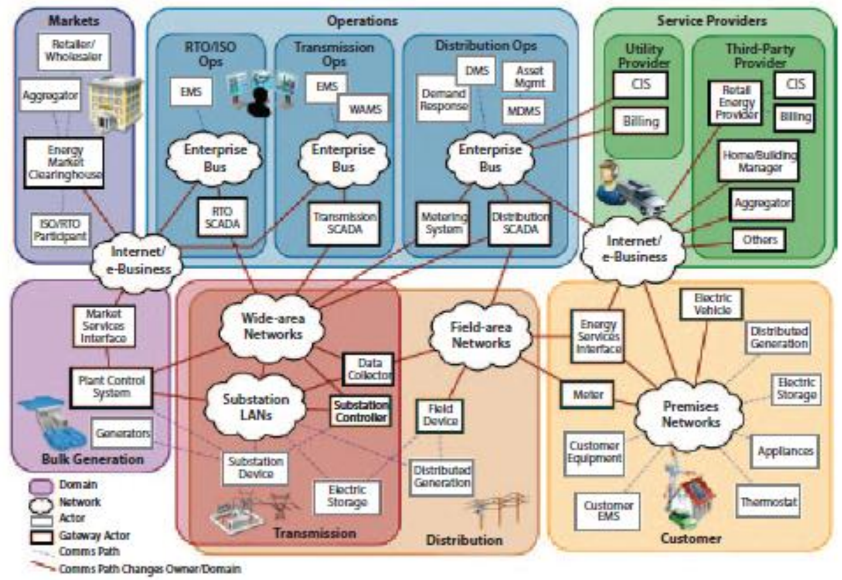
Pepco Holdings, Inc

Advanced Communications

"Over the next 20 years, the growth in percentage terms of data flowing through grid communications networks will far exceed the growth of electricity flowing through the grid".

The Future of the Smart Grid – Massachusetts Institute of Technology, 2011

- The key to the evolution of Utility 2.0 will be the establishment of a reliable and robust communication system for quickly transporting large volumes of data
- Communication systems will need to interface with a variety of grid components and will consist of:
  - Private utility owned wide-area networks
  - Public communications networks
  - Commercial communications networks
  - Home and commercial premises networks



Source: National Institute for Standards and Technology, *NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0*, special publication 1108 (Washington, DC: U.S. Department of Commerce, 2010), 35, http://www.nist.gov/public_affairs/releases/upload/smartgrid_interoperability_final.pdf.

- Using "open standards" will ensure that investments are realized over a longer life and that alternatives can be easily considered as they arise
- Security is very important for reliability and protection from unwanted intrusion

Pepco Holdings, Inc

Smart Grid initiatives are accelerated through DOE funding…

	Pepco-DC	Pepco-MD	ACE-NJ
	-280,000 smart meters -20,000 DLC devices -17 ASR schemes -Dynamic pricing -Enabling comms	-570,000 smart meters -168,000 DLC devices -62 ASR schemes -Dynamic pricing -Enabling comms	-25,000 DLC devices -20 ASR schemes -158 Capacitor banks -Enabling comms
Total Cost	**$89.2M**	**$209.6M**	**$37.4M**
DOE Funded	**$44.6M**	**$104.8M**	**$18.7M**

Benefits to Customers

- Acceleration of installation of meter and thermostats
- Acceleration of benefit for customers to manage their energy use
- Modernization of the electric system to reduce outages, better manage the operation of the system and reduce losses

DE AMI results achieved during Hurricane Irene (Aug 2011)

Background

- Approximately **445,000 customers** were **without power** at the height of the storm
- Overall in Delaware, there were **~1,900 outage events** according to the Outage Management System (OMS)

AMI Outage Detection

- As they were losing power, DPL Delaware **AMI meters sent "last gasp" messages**, which were **processed by the OMS** similar to a customer call
- **Last gasp messages** help to **predict the location and extent** of outages
- Company personnel can determine if there is **line side power at the customer's meter** by **"pinging"** the meter
- **30 percent of the 1,900 outage events** were **cancelled a**s a result of the meter pings
- As a result of the cancellations, **calls back to customers** or **truck rolls** to the affected event area to verify power restoration were **eliminated, allowing focus on actual outages**

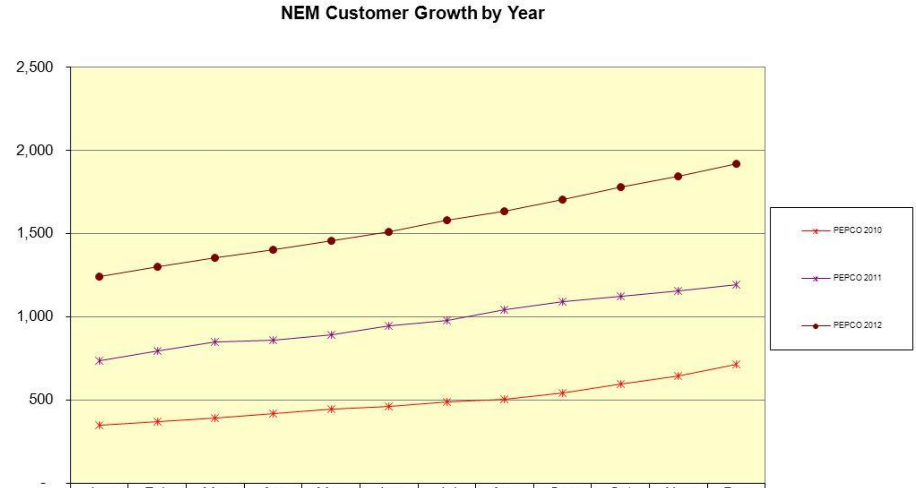
In Delaware, AMI outage detection proved useful during restoration efforts from Hurricane Irene as data eliminated the need to dispatch crews to hundreds of outage locations

Renewable Integration and Microgrids

- Pepco has successfully completed the interconnection of over 1,900 customer renewable energy systems

- Pepco is working on an advanced modeling program to rapidly provide the studies necessary to safely connect these systems to the grid

- Pepco is an industry leader in addressing the effects of interconnection renewables and actively participates in standards development efforts



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PEPCO 2010	349	371	389	419	443	458	489	505	540	593	642	712
PEPCO 2011	736	795	846	859	891	946	977	1,042	1,089	1122	1,154	1193
PEPCO 2012	1,243	1,300	1,353	1,401	1,453	1,511	1,578	1,635	1,701	1,781	1,845	1,918

- Pepco now is working on using advanced inverter designs that communicate with the grid and allow a higher level of voltage control than was ever available before

- Advances in sectionalizing equipment increases microgrid options

It is critical to integrate distributed and renewable generation in ways that do not compromise system reliability, power quality or safety

Pepco Holdings, Inc

PHI is a leader with Green Button Initiative

- White House / industry initiative
- Common-sense idea that electricity customers should be able to download their own energy usage information in a consumer- and computer-friendly format
- A common experience, from provider to provider, setting clear expectations that their information is theirs to have – and share if they want to
- A contest was recently held for developing Apps that could collect, analyze and present this data
- Low barrier to consumer access

The smart grid provides more energy use information and more choices for customers on how to use it

Implementing/Committed Utilities
- *PG&E*
- *SDG&E*
- *SCE*
- *City of Glendale*
- *Oncor*
- *Pepco Holdings (MD, DC,DE, NJ)*

Implementing/Committed Vendors
- *OPower*
- *eMeter*
- *Tendril*
- *Aclara*
- *Itron*

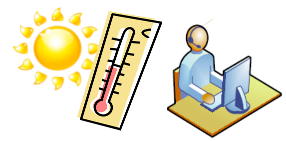
The Peak Energy Savings Credit Program

Introduces a new rate structure with a credit option designed to incent customers to reduce consumption during Peak Energy Periods

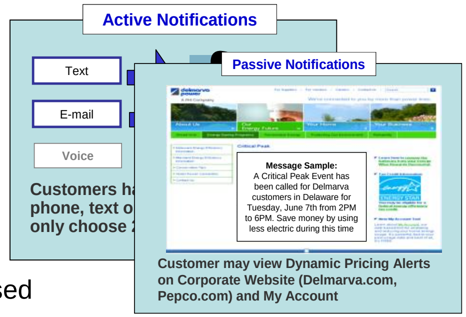
1 Peak Energy Savings Credit Enrollment

- PHI defaults a customer to CPC
- Customer sets notification preferences or opts-out of the Dynamic Pricing rate (through My Account or a CSR)

2 Initiate Peak Energy Period / Notify Customers

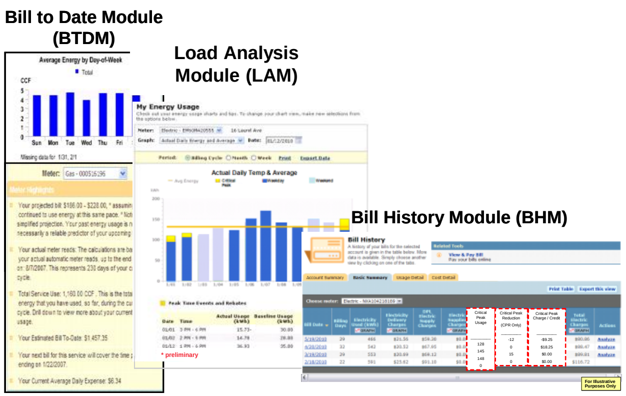


- PHI Power Procurement initiates a Peak Energy Period for the next business day
- Customer receives notifications based on his preferences

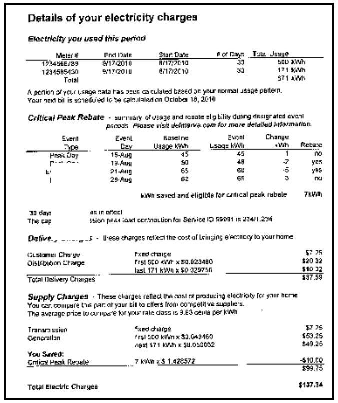


3 Customer Views Peak Energy Period Results

- Event results are visible to the customer on the Aclara modules, accessed through My Account



4 Customer Receives Dynamic Pricing Bill



Details of your electricity charges

- A Dynamic Pricing customer will see interval information in the meter section, a Peak Energy Credit table with event information and Peak Energy Credit savings information

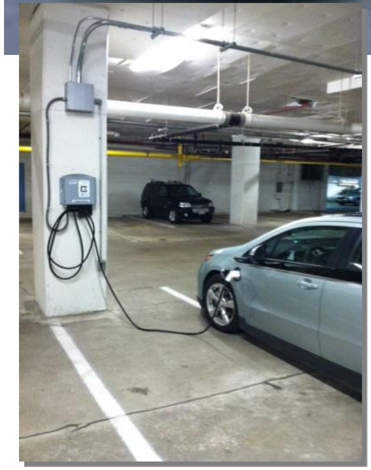
PHI Current Efforts with EVs

- Completed our participation in EPRI / Ford Escape PHEV Program
- Continue to evaluate 10 Chevy Volts in fleet
- Continue Testing of installed Charging Stations

Level 2	**Level 1**
3 Edison Place	**5 at Edison Place**
1 NCRO	**1 at NCRO**
1 Bay Region	
1 ACE	
1 Rockville	
1 Forestville	
1 Benning	

- Testing EVSE communication & DSM mini pilot using the Chevy Volts and AMI communications system
- Submitted a proposal for an EV program in MD
- Established EV Leadership
  - Board Member of Electric Drive Transportation Association
  - MD Electric Vehicle Infrastructure Council
  - MD PSC EV Working Group
- Continue to support standards as well as State regulatory and legislative efforts to prepare for PEVs

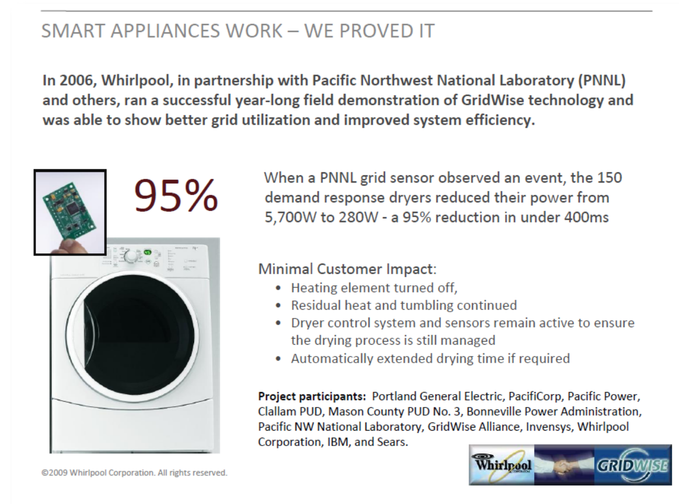




Home Area Network and Demand Response

- Studies have shown that customers who get frequent information on their energy use may additionally conserve up to 15%
- Typical smart in-home display shows:
  - Power consumed since last bill
  - Estimated bill since last bill
  - Current price of power
  - Price Signal Information
  - Other Messaging

- Traditional utility direct load control programs are used infrequently because they are designed for providing reliability under emergency conditions or peak shaving on a small number of hours per year
- The untapped potential for reducing electricity usage is likely to lie in residential behavioral changes
- The Home Area Network will be a key medium for engaging demand and providing new benefits to customers



SMART APPLIANCES WORK – WE PROVED IT

In 2006, Whirlpool, in partnership with Pacific Northwest National Laboratory (PNNL) and others, ran a successful year-long field demonstration of GridWise technology and was able to show better grid utilization and improved system efficiency.

95%

When a PNNL grid sensor observed an event, the 150 demand response dryers reduced their power from 5,700W to 280W - a 95% reduction in under 400ms

Minimal Customer Impact:
- Heating element turned off,
- Residual heat and tumbling continued
- Dryer control system and sensors remain active to ensure the drying process is still managed
- Automatically extended drying time if required

Project participants: Portland General Electric, PacifiCorp, Pacific Power, Clallam PUD, Mason County PUD No. 3, Bonneville Power Administration, Pacific NW National Laboratory, GridWise Alliance, Invensys, Whirlpool Corporation, IBM, and Sears.

Deployment of AMI and complementary technologies enhances potential demand response to supply conditions and may enable improved energy efficiency and conservation. ***The Future of the Smart Grid – Massachusetts Institute of Technology, 2011***

Innovations in Regulation – Pepco Heeds Maryland's Grid Resiliency Task Force

- Pepco takes new steps to improve customer service and reliability
  - Accelerate next four-year tree-trimming cycle to complete the cycle in three years
  - Upgrade an additional 12 feeders a year for two years (on top of the four dozen feeders already being done each year)
  - Underground six distribution feeders (three in Montgomery County and three in Prince George's County), to significantly improve reliability in both day-to-day and storm conditions

- Because Pepco is proposing to accelerate investment and receive timely recovery of costs, it is also proposing to accelerate the reliability standards it has to meet

- Pepco has proposed performance-based ratemaking that rewards Pepco if the accelerated reliability standard is achieved and credits customers if the accelerated reliability standard is not met

Pepco Rate Case No. 9311

- Filed November 30, 2012
- Decision anticipated July 1, 2013
- Proposed $60.8 million increase in base distribution rates to help pay for reliability investments
  - Feeder improvements
  - Distribution automation
  - Substation improvements
- Proposed Grid Resiliency Charge
  - Full PSC review of project prudency
  - Covers only accelerated projects
  - Would take effect on Jan. 1, 2014
  - Expected to extend for about three years
  - Total cost of accelerated projects estimated at $180 million
  - Only a portion of the accelerated projects to be recovered through the grid resiliency charge
  - Balance of costs will be included in a future rate case and collected over the remaining life of the assets, roughly over 30 years

Closing Thoughts

- Customer benefits and customer satisfaction drive grid modernization
- Smart Grid technology is revolutionizing how utilities operate, and allowing unprecedented customer choices
- Key to success will be a constant scan of developing technologies that can be safely integrated into the grid without adversely affecting, and hopefully improving, reliability
- Pepco is implementing technologies that improve service reliability, speed power restoration, and provide customers with new options
- Opportunity exists for partnerships with telecom companies, internet businesses and others to develop new customer services
- As recognized by Maryland's Grid Resiliency Task Force, regulatory policies also need to change

Questions?

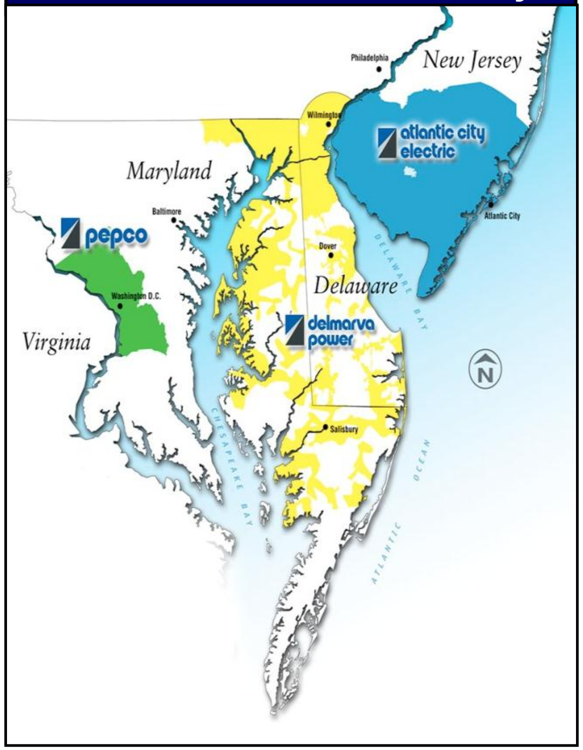
Also connected with our customers through:

APPENDIX

PHI is an electric and gas utility serving almost 2 million customers in New Jersey, Delaware, Maryland and Washington D.C.

Operating Company	Service	Customers	GWh	Bcf	Service Area
pepco A PHI Company	Electric	787,000	27,665	N/A	640 square miles – District of Columbia, major portions of Price George's and Montgomery Counties in Maryland
delmarva power A PHI Company	Electric Gas	500,000 123,000	12,853 N/A	N/A 19	5,000 square miles – Delmarva Peninsula 275 square miles – Northern Delaware
atlantic city electric A PHI Company	Electric	548,000	10,165	N/A	2,700 square miles – Southern one-third of New Jersey
Regulated Utility Totals		1,958,000	50,703	19	8,340 square miles
pepco Energy Services	Energy Services Business	Various Large Government & Institutional	N/A	N/A	Develops, installs, operates, and maintains energy efficiency, renewable energy, and combined heat and power projects; Business represents 5% - 10% of operating income

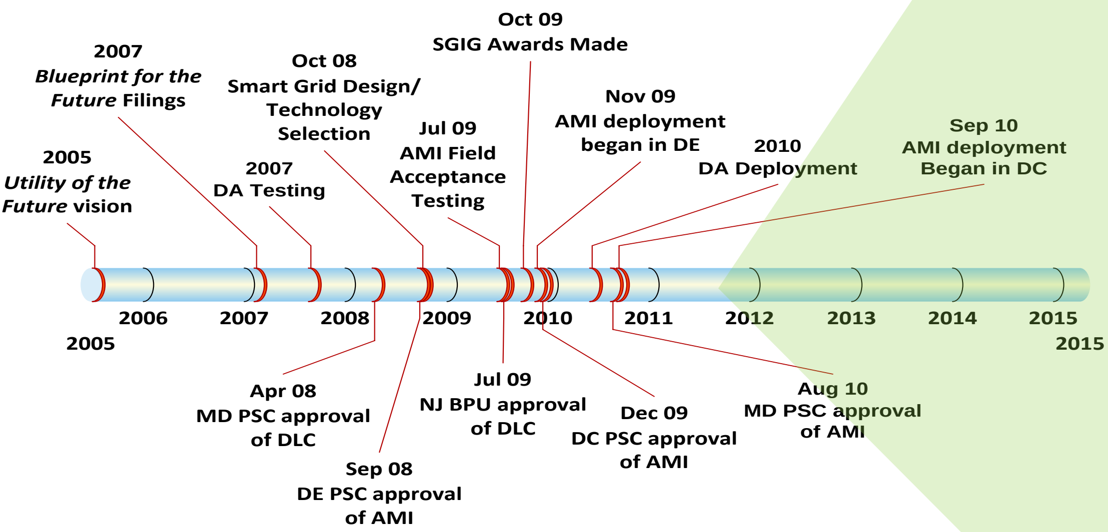
Combined Service Territory



PHI's Path to the Smart Grid

PHI began its Smart Grid planning in 2005 and has been progressing rapidly in its Smart Grid implementation with the Smart Grid Investment Grant (SGIG) awards.

PHI received 3 grants from US DOE
- $168m for Smart Grid;
- $700K for Synchrophasor deployment;
- $4.4m Workforce Training.



- **AMI Meters Installed**
  - **DE Complete**
  - **MD 255,016**
  - **DC 268,088**
- **Communications Installed**
  - **DE Completed**
  - **MD 118 APs / 272 Repeaters**
  - **DC 65 APs / 69 Repeaters**
- **Phase One AMI Benefits**
  - Over the Air Meter Reading
  - Interval Data on Web and Bill
  - Outage Detection
  - On-demand meter reads
- **Peak Energy Savings Credit (Critical Peak Rebate)**
  - 7,000 customers in Delaware
  - 5,000 customers in Maryland
- **Advanced DA Schemes Installed**
  - MD 1 Commissioned / 4 in progress
  - DC 3 in progress
- **DGA Transformer Monitors**
  - MD 8 Installed / 4 In progress
  - DC 10 Installed / 4 In progress
- **Residential URD Monitors**
  - MD 84 Field Devices Installed / 116 In Progress
- ***Green Button* now available**

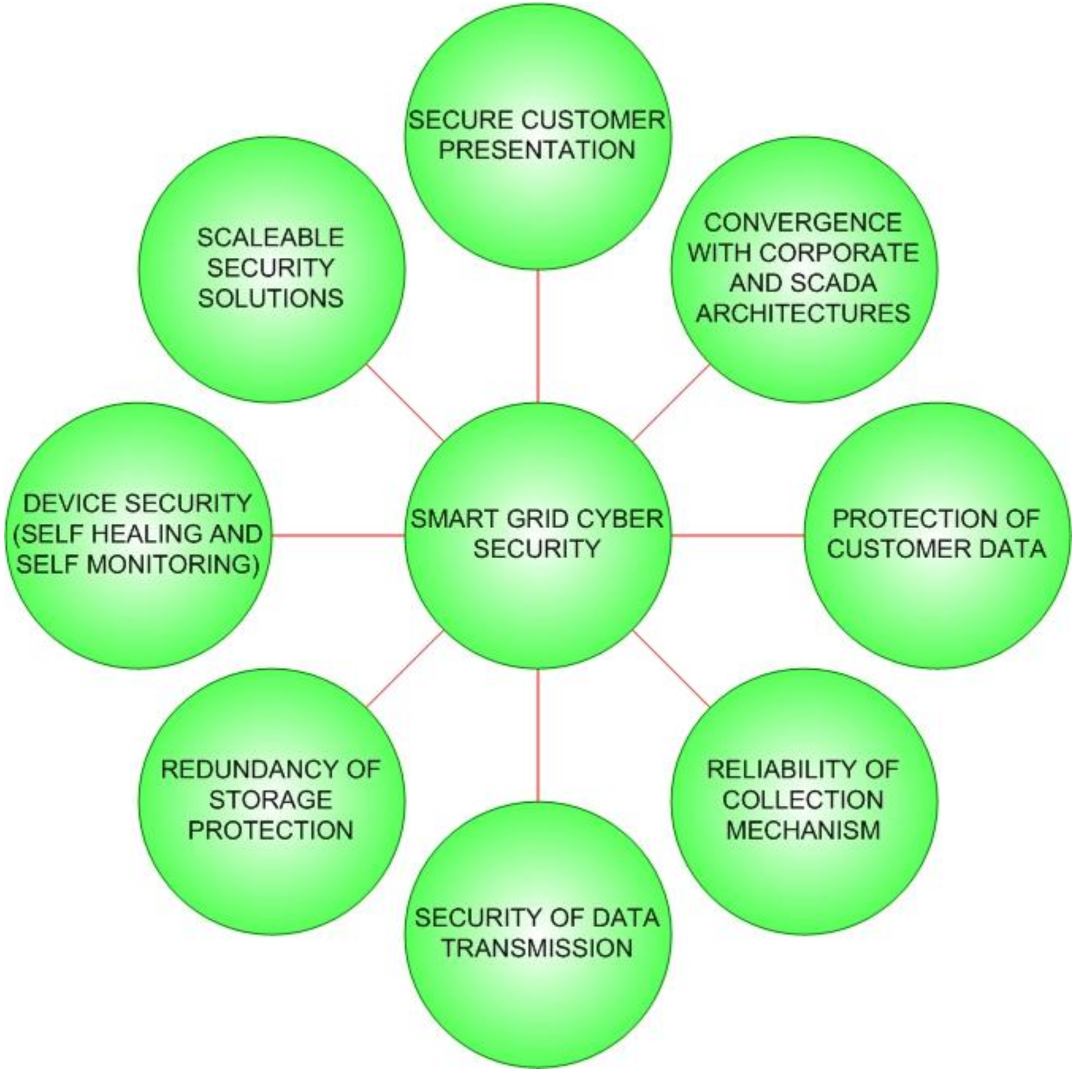
Pepco Holdings, Inc

PHI Current Grid Awareness and Management Projects

- Automatic Sectionalizing & Restoration (ASR) Schemes
  - ASR entails the installation of advanced devices that are designed to work together to identify distribution feeder faults, automatically isolate identified faulted area, and reroute electricity supply to segments of the outage feeder un-impacted by the fault. This will reduce the number and length of electric system outages, resulting in increased reliability and customer satisfaction.
- Dissolved Gas Analysis (DGA) Monitors on Substation Transformers
  - This on-line system will continuously monitor eight critical fault gases and other transformer insulating oil key parameters for a timely assessment of transformer conditions to schedule maintenance and help prevent failures.
- URD Fault Detectors System –FDS
  - This system will identify the location of faulted URD transformers by conveying a signal back to the control center in order to reduce time spent by crews in locating faults.
- Network Transformer Protector Remote Monitoring System - RMS
  - This system will provide real time remote control/monitoring capability as well as power quality information such as phase currents, transformer loading, power factor, etc. to network transformers through implementation of two way communication and installation of intelligent sensors for an enhanced reliability of the network system.
- Capacitor Bank Automation
  - This project will add feeder capacitors that have two way communications for supervisory control capability and visibility. This will allow remote control of feeder reactive power (VAr) and resolution of high/low voltage issues.

Smart Grid CyberSecurity Challenges

- Need to <u>protect</u> Interval or usage data from non-authorized users
- Need to <u>protect</u> meters from being abused as control channel into grid operations
- Need to <u>protect</u> future two-way communications for meter activity
- Need to ensure future control capability is <u>secure</u>



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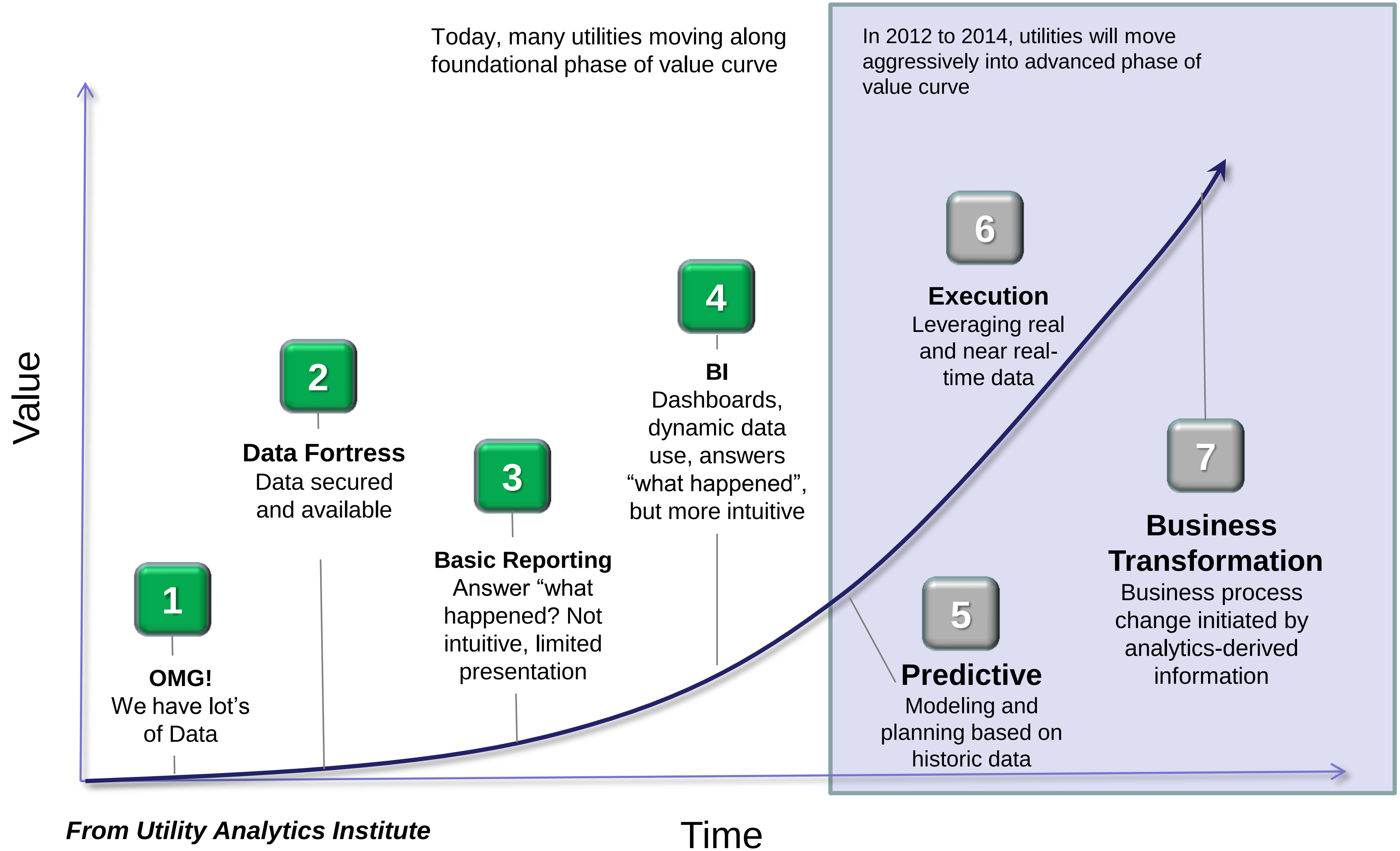
Utility 2.0 Data Analytics Vision

Data Analytics Will Become More Dynamic Over Time



From Utility Analytics Institute

Pepco Holdings, Inc

PHI Deployment of Direct Load Control

Path to activating the Home Area Network and engaging demand

Energy Wise Rewards NJ

- **Comverge selected as vendor**
- Smart Thermostats and Outdoor switches
- Program Currently Underway
- 25,000 Devices total
- Over 16,000 Device installed to date

Energy Wise Rewards MD

- **Comverge selected as vendor**
- Smart Thermostats and Outdoor switches
- Program Currently Underway
- 222,000 by Devices by 2013
- Compatible with AMI
- Over 100,000 Devices installed to date

- *PHI is planning a pilot of HAN devices in conjunction with PTR Pilot and rollout in MD*
- *PHI will wait for SEP 2.0 before considering full deployment of HAN* Devices

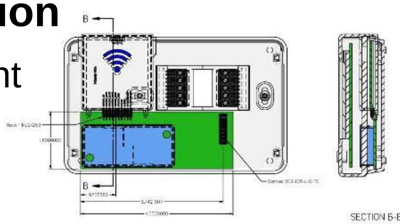
Smart Stat → IHD → APP

Web Portal

Migration plan:

- Order of device deployment
  - Web Portal
  - Smart Thermostat / Integrated IHD
  - Stand Alone IHD
  - SmartPhone App

Comverge Intellitemp Solution



- Changed platform from segment touch screen to dot matrix and keeping same font size of key elements
  - Flexibility & capability
  - Built-in IHD
  - More user friendly
- Full remote firmware upgradability
  - Ability to migrate to future Smart Grid functions
- U-SNAP swappable communication module option

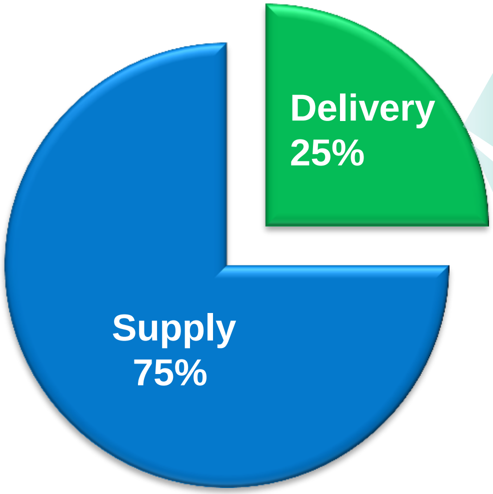
Pepco Holdings, Inc

Benefits and Costs flow to Customers through both the Delivery and Energy components of the bill . . .

Customer Peak Load Savings
- Critical Peak Rebate Dynamic Pricing to incent Demand Response
- Energy Conservation

Enhanced Customer Service
- Web presentment of daily & hourly usage
- Energy Advisor conversations
- Bill to Date and Projected Monthly Bill
- Outage Detection
- Rate Comparison for CPR and CPP

Approximate Residential Customer Bill Breakdown



Energy Delivery Benefits
- Reduce Manual Meter Reading Costs
- Remote Service Switch
- Improve Billing Activities
- Reduce Off-Cycle Meter Reading Costs
- Asset Optimization
- Other Operational Efficiencies

Costs to Deploy
- Electric Meters
- Gas IMUs
- Communication Network
- Integrated IT Systems

Pepco's Grid Modernization Projects

Introduction

- The Potomac Electric Power Company (Pepco) constantly incorporates new technologies into the electric grid. However, Pepco began systematically rethinking and modernizing the grid in 2005 with its *Blueprint for the Future* and the formal deployment of Smart Grid planning. Since 2005, Pepco has progressed rapidly in Smart Grid implementation.

- Pepco currently is discussing its modernization projects with the Energy Futures Coalition (EFC). EFC currently is responding to an invitation from the Maryland Grid Resiliency Task Force [footnote omitted] (Grid Resiliency Task Force) to propose a pilot project for what EFC terms the "utility 2.0." Pepco is providing this material to EFC to assist it in its efforts.

- Pepco will generally test new technologies and platforms in trial or pilot form; once testing is complete, Pepco makes new equipment and programs available to all eligible customers. Therefore, Pepco generally is installing Smart Grid equipment and platforms, including those noted below, throughout its service territory.

- Over the last seven years, Pepco has focused on integrating advanced digital electronics and communications technologies into the grid. In marrying computer and communications technologies to the grid, Pepco is providing increased grid capabilities, including grid diagnostic and self-healing systems. These technologies improve system resiliency and provide more and better information for customers and the Company, and are economical. These technologies not only improve grid operations and provide customers with new and better services, but also allow for increased communication with customers and the provision to them of energy usage data and analysis that enable informed decisions by customers in how and when they use electricity, thereby saving them money and providing environmental benefits for society as a whole.

- The new technologies often are evolutions of existing, standardized equipment. For example, the communications and computing equipment and systems that Pepco is integrating into the grid usually are off-the-shelf products offered by multiple vendors. Among other benefits, this allows Pepco broad price negotiating leverage and the ability to incorporate new and evolving cybersecurity measures into the grid as they are incorporated into the products.

- Another example of a product that has evolved over time and that Pepco is using in its grid modernization efforts is equipment that allows the utility to isolate a single customer or even a section of the grid from the rest of the grid. This "sectionalizing" equipment has existed for decades, and it, among other services, allows customers to operate their own generation that serves their sectioned-off portion of the grid without endangering the lives of persons working on portions of the grid outside of the sectionalized portion. Thus, this sectionalizing equipment is a critical component in enabling the design and operation of microgrids.

- A major development that has awakened new interest in microgrids, however, is the evolution of advanced equipment that operates automatically in the event of a triggering occasion, such as an outage on the main portion of the grid. In those events, if the customers served by the microgrid have the ability to operate their own generation source that connects directly to the microgrid while isolated from the main grid, those customers could automatically retain service even if the rest of the grid is experiencing outages. Generation sources for microgrids can include renewable resources such as wind and solar, fuel cells (such as those from Bloom Energy that Delmarva Power & Light Company, an affiliate of Pepco, is using in a project in Delaware), and also combined heat and power applications.

- Pepco is one of the leading companies in the deployment of smart grid technologies and supporting systems. Pepco is always willing to consider new ideas and concepts and is willing to discuss further the combination of existing systems and designs that could meet the goals of the Governor's Grid Resiliency Task Force. Listed below is a summary of the activities that Pepco currently has underway:

Automatic Sectionalizing & Restoration (ASR) Equipment

- Pepco is deploying ASR schemes throughout its service territory. ASR entails the installation of advanced devices that are designed to work together to identify distribution feeder faults, automatically isolate identified faulted area, and reroute electricity supply to segments of the outage feeder not impacted by the fault. This will reduce the number and length of electric system outages, resulting in increased reliability and customer satisfaction. ASR arrangements may also be able to be used to facilitate microgrids, as discussed above.

Advanced Meters

- As part of a broader Pepco Holding, Inc. initiative, Pepco is installing over a half million advanced meters in its Maryland service territory. Advanced, or "smart," meters have sensors, metering and communications equipment that allow for automated outage detection and on-demand meter reads. In addition, they provide for customer monitoring of their own energy consumption, participation in energy efficiency and demand response programs, such as rebates for not using electricity during times of peak demand, and many other activities that have environmental and economic benefits. More than 80% of Pepco's Maryland customers have a smart meter already. Full deployment is anticipated by April 2013.

Advanced Communication and Sensor Equipment

- Pepco is deploying advanced sensors and communications equipment not only in meters but also at other points in the distribution grid. This equipment can monitor and report system voltage levels and power quality, aiding in diagnostics and pinpointing potential problem areas before a problem actually occurs.

Net Energy Metering

- Net energy metering (NEM) allows individual customers (and in some instances groups of customers) to install and operate solar, wind and several other generation technologies and receive bill credits for the excess energy their generation equipment produces. PHI has successfully completed the interconnection of over 4,800 customers. Pepco uses a “green team” model to assist customers interested in NEM to make sure that their systems have the appropriate safety equipment that operates automatically in the event of an outage on the customer’s distribution circuit. The green team also advises on installation and NEM protocols to help customers take advantage of the attractive NEM rates. Since customer-owned generation has the potential to affect the quality of distribution service received by neighboring customers, Pepco uses an advanced modeling program to allow for rapid and thorough interconnection studies to facilitate the deployment of these resources.

Dissolved Gas Analysis (DGA) Monitors on Substation Transformers

- This on-line system continuously monitors eight critical fault gases and other transformer insulating oil key parameters for a timely assessment of transformer conditions to schedule maintenance and help prevent failures.

Underground Cable (URD) Fault Detectors System

- This system identifies the location of faults at URD transformers by conveying a signal back to the control center. This system speeds notification to Pepco of an outage on URD cable, and also reduces time spent by crews in locating faults.

Network Transformer Protector Remote Monitoring System

- This system provides real time remote control/monitoring capability as well as power quality information such as phase currents, transformer loading, power factor, etc. to network transformers. It uses two way communication systems and intelligent sensors.

Capacitor Bank Automation

- This project adds feeder capacitors that have two way communications for supervisory control capability and visibility for the capacitor banks. This capability allows remote control of feeder reactive power and resolution of high/low voltage issues before such issues become a problem for customers and customer equipment.

Additionally, Pepco is currently initiating the following additional programs:

Green Button

- Green Button is based on the concept that electricity customers should be able to download their own energy usage information in a consumer- and computer-friendly format. Green Button is a joint initiative of the White House and industry, and has as a goal that if and when a customer moves to the service area of a different utility, he or she should be able to find the identical or nearly identical Green Button platform provided by his or her new utility, rather than having to master a new and different interface.

Home Area Network and End-User Applications

- Pepco currently is testing advanced home devices and various communications systems that allow customers to control their appliances and energy systems.

Microgrids

- As noted above, smart meters, automatic sectionalizing equipment, new sources of generation and other advances have awakened new interest in microgrids. Pepco is willing to work with customers who want the added security of a microgrid, provided that they install and pay for the appropriate sectionalizing safety equipment. Pepco has had discussions with customers in campus-type settings, and is willing to explore use of microgrids in other settings as well.

Undergrounding

- In the summer of 2012, Pepco announced it was embarking on a major new study of the feasibility of undergrounding portions of its electric distribution system. Pepco included the study in its November 2012 rate case filing with the Maryland Public Service Commission, in support of specific proposals to begin undergrounding distribution circuits in both Montgomery County and Prince George's County. Pepco's study also examined the feasibility of placing certain distribution substation supply circuits underground, among other facilities. Pepco is very interested in working on these initiatives with the Public Service Commission, customers and other stakeholders.

Performance-Based Ratemaking

- In response to recommendations of the Grid Resiliency Task Force, Pepco volunteered to undertake the accelerated reliability work necessary to meet increased (tougher) reliability standards. In further conformance with the Task Force's recommendations, Pepco has asked the Commission to allow it to begin recovering the costs of that accelerated work through a grid resiliency charge, and has designed and proposed a performance-based component of its rates. Pepco proposes that if it does not meet the tougher standards it will provide a credit to customers' bills, but that if it exceeds those tougher standards it will be eligible for an incentive payment. As noted above, Pepco is proposing distribution circuit undergrounding projects in both Montgomery and Prince George's Counties as part of this grid resiliency initiative.

Dynamic Pricing

- In conjunction with its Smart Meter deployment, Pepco is completing a trial program on critical peak rebates, to be followed later in 2013 by full deployment of this program. Critical peak rebates reward customers for reducing consumption during times when electricity prices are high. Participating customers save money on their electric bills, and all customers benefit from lower electricity commodity prices.

EmPOWER Maryland

- Pepco remains hard at work implementing a host of energy efficiency and demand response programs in Maryland. The deployment of smart meters will increase opportunities to implement new programs and provide enhancements to some existing programs. These programs provide opportunities for participating customers to save money on their own electric bills, and also to help lower electricity prices for all customers as well as providing the environmental benefits arising from reduced electricity generation requirements.

Electric Vehicles (EVs)

- Pepco has been participating in a Maryland Public Service Commission working group to prepare a proposal for EV vehicle charging. A growing number of Pepco's customers are purchasing plug-in electric vehicles. Pepco will be proposing electric rates that encourage EV charging during times of day when demand for electricity is low. Such rates are not only economically efficient, but they also can minimize additional distribution grid investment that EV charging sometimes requires. Additionally, Pepco is deploying Chevrolet Volts and both passenger and hybrid bucket trucks in its fleet.

Pepco is one of the leading companies in the deployment of smart grid technologies and supporting systems. Pepco is always willing to consider new ideas and concepts and is willing to discuss further the combination of existing systems and designs that could meet the goals of the Grid Resiliency Task Force.

Utility 2.0 Pilot Consideration

Proposal for Discussion with Energy Future Coalition

February 1, 2013

Discussion Goals

- Perspective on Utility 2.0
- Reliability & Grid Resilience Initiatives
- Engaging the Customers
- Regulatory Innovation
- Pilot Consideration
- Beyond the Pilot

Perspectives on Utility 2.0

BGE appreciates the work and recommendations of the Governor's Grid Resiliency Task Force.

- We appreciate the opportunity to be part of and contribute to the work of the Task Force and the consideration of potential pilot opportunities

BGE has a similar, long standing vision for the future

- "Smart" energy distribution system that safely and reliably meets the needs of our customers, today and in the future
- Successful integration of new technologies and distributed resources
- Engaged customers, with tools and information to manage their energy use and costs, while supporting the system reliability and operations

BGE's Innovation in Reliability and Safety

- BGE has been incorporating Distribution Automation on the distribution system for over 20 years. The original design was to use sectionalizing and recloser capability to minimize the number of customers affected by faults and to provide remote switching capabilities. BGE has expanded on the core DA capability by implementing a centralized Auto-Restoration application which further isolates the fault and reconfigures the downstream devices to restore additional customers after momentary outages.
- BGE makes significant investment each year in system upgrades, renewal and maintenance in cable replacements, system enhancements, line and equipment maintenance and vegetation management. In addition, we have developed the operating and reporting procedures needed to support the PSC's RM 43 and RM 44 safety and reliability improvement initiatives.
- BGE routinely performs targeted reliability improvements including vegetation management, selective undergrounding and other system enhancements across the distribution system and, in particular, for neighborhoods and communities experiencing greater than expected reliability challenges.
- We have recently launched enhanced outage reporting and tracking tools including on-line and mobile applications to assist in keeping customers informed of the progress and projected restoration times

Innovation in Reliability and Safety -continued

- Deployment of BGE's Smart Grid with over 1.2 million electric and 650,000 gas smart meters and the supporting infrastructure, and back-end enterprise platforms for communications, information management, billing and analytics. The Smart Grid will provide significant operational and customer benefits like outage detection and voltage monitoring and enable customers to have a hands on role in managing energy use and supporting system reliability
- BGE is implementing a Conservation Voltage Reduction pilot to demonstrate and evaluate strategies and technologies to improve feeder and system voltage control capability reducing overall energy requirements and losses.
- BGE is evaluating the application of advanced remote fault circuit indicators, with the potential to identify potential trouble locations and communicate the information back to system operations for analysis, reducing time needed to identify the outage location and initiate a response.

Engaging New Technologies and Distributed Resources

- BGE routinely monitors and assesses the advancement, developments and customer interest in technologies from distributed resources, fuel cells and renewable generation to plug-in vehicles and energy storage.
- BGE has developed a hand's on understanding of plug-in vehicles and the potential impact to the distribution system. We have initiated processes for tracking EV utilization and assessing potential reliability concerns and have monitoring trial in place in the field. BGE has been an active participant in the Maryland EV Infrastructure Council and the PSC EV Working Group. BGE has proposed an Electric Vehicle Off-Peak charging rate for pilot implementation in 2013 to encourage customers to charge their EV's in off peak periods.
- BGE supports the integration of renewable and distributed generation on the distribution system that is interconnected and operated in a manner that supports the safe and reliable operation of the utility and customer systems and equipment. BGE has connected over 2200 customers with self generation and net metering through the end of 2012.

Engaging the Customers

BGE offers a range of energy efficiency and demand response programs to help customers conserve energy, save money, and support system operations. The programs support the EmPOWER Maryland Act and goals.

- Residential programs include incentives for efficient lighting, appliances, heating and cooling systems, home energy check-ups, comprehensive audits and incentives for Energy Star qualified new homes.
- BGE's programs for small businesses and larger commercial and institutional customers offer incentives for conversions to efficient light, heating, cooling refrigeration, plug loads, motors and comprehensive options for new construction and process specific projects and measures.
- BGE's Combined Heat & Power program offers up to $2 million to industrial and commercial customers who install qualified on-site systems

BGE's Peak Rewards program is designed to help ease "peak" demand for electricity in our region. The program allows customers to reduce peak demands with an A/C switch or programmable thermostat while saving money.

Engaging the Customers through the Smart Grid

- BGE is deploying a Smart Energy Manager suite of energy management tools for our customers with smart meters. Customer are able to set a target budget every month and track how they are doing. The Smart Energy Manager suite will provide Home Energy reports, interactive on-line tools and tips and opportunities for email and text alerts.
- BGE has conducted a highly successful multi-year pilot of dynamic pricing options where customers receive incentives for reducing energy use at times BGE identifies as "critical". The pilots showed significant promise with both energy reduction results and customer satisfaction. Smart Energy Rewards will deployed for customers with Smart Meters beginning in 2013.
- BGE has evaluated in-home display technologies and conducted an in-home evaluation of the available technology and communication capability. The results helped to shape the Smart Energy Manager strategy.
- BGE will be participating in the national Green Button initiative that will allow customers to access their household energy use in a standardized format and use the information to manage their energy use and costs.

Regulatory Innovation

- BGE supports the work of the Task Group and the recommendations to develop innovative funding options to support increased investments in grid reliability and performance. BGE is closely monitoring the Pepco Case 9211 and the proposed “Grid Resiliency Charge” to fund accelerated and incremental work to improve reliability of the distribution system.
- BGE supports the STRIDE legislation, currently in consideration in the Maryland legislature, that proposes a reasonable customer charge to fund expedited main replacements on the gas system supporting safety and reliability of the system.
- BGE’s gas and electric rates have been “decoupled” since 1998 for gas service and 2008 for electric service. Decoupling removed the inherent barriers to developing programs that reduce revenues but may provide other significant customer benefits. Decoupling has enabled BGE to aggressively promote and support Energy Efficiency, Demand Response and other customer programs.
- The common practice of the MD PSC is to use an historical test year with average rate-base in determining future revenue requirements. This results in a “regulatory lag” in cost recovery particularly challenging to programs that require substantial capital investments over short periods. In our current rate case, BGE has proposed several adjustments to their historical test year for investments that are known, measurable and support requirements for safety and reliability to reduce the regulatory lag and support funding for the desired initiatives.

Pilot Consideration

Pilot Consideration

BGE currently has a number of initiatives underway to continue to improve reliability and system performance

- Proposed to leverage this work and accelerate testing and evaluation of advanced, innovative sensing and restoration technologies and circuit designs to improve reliability and enhance restoration capabilities
- The goal of the pilot is to assess the cost/ benefit of various levels of technology application including in-line switches, reclosers, fault current indicators and sectionalizers on system operation, reliability and restoration performance.
- BGE is not requesting advanced cost recovery for the proposed pilot work at this time, however it is anticipated that consideration would be needed to support a broader deployment of successful applications.

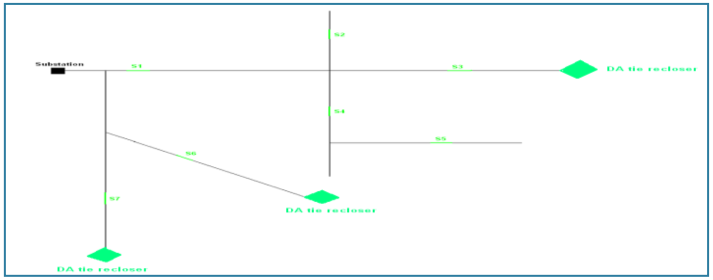
Pilot Consideration

BGE proposes to select up to four feeders for accelerated reliability design and configuration enhancements:

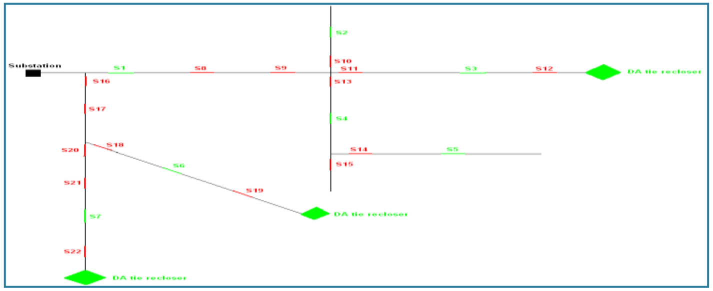
- Review the feeder configuration and performance and identify optimum placement of in-line switches to enhance switching and outage restoration capabilities. Prepare estimates of the contribution to reliability (CAIDI) and overall cost benefit, monitor actual results
- Further review the feeder configurations and performance and identify locations where in-line switches can be replaced with DA reclosers
- Further evaluate the feeder performance and identify optimum number and locations for fault circuit indicators. Compare projected benefits to actual performance
- The final step is to further review the feeder configuration for optimum placement of SCADA controlled in-line sectionalizers to further reduce the duration of outages by allowing remote restoration of portions of the feeder and more precise locations for dispatch of repair crews.

Pilot Concept Overview – Steps 1 - 3

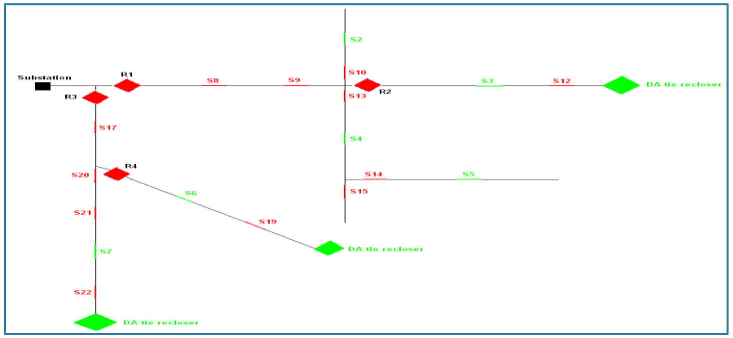
Assess feeder configuration and performance



Assess potential improvements from in-line switches



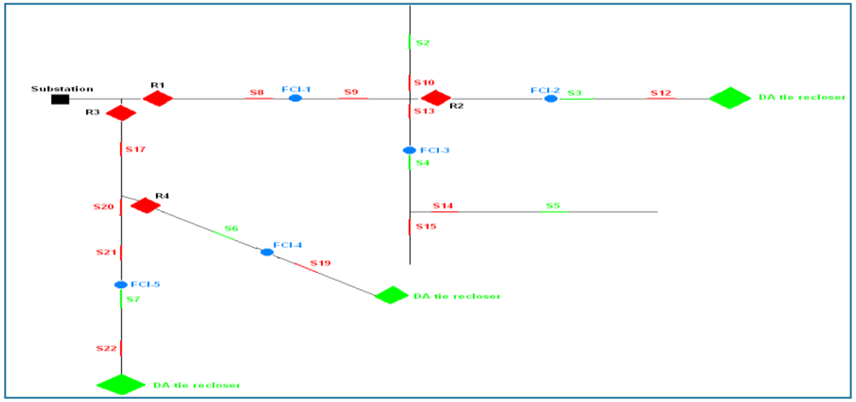
Assess potential improvements from further upgrades to DA reclosers



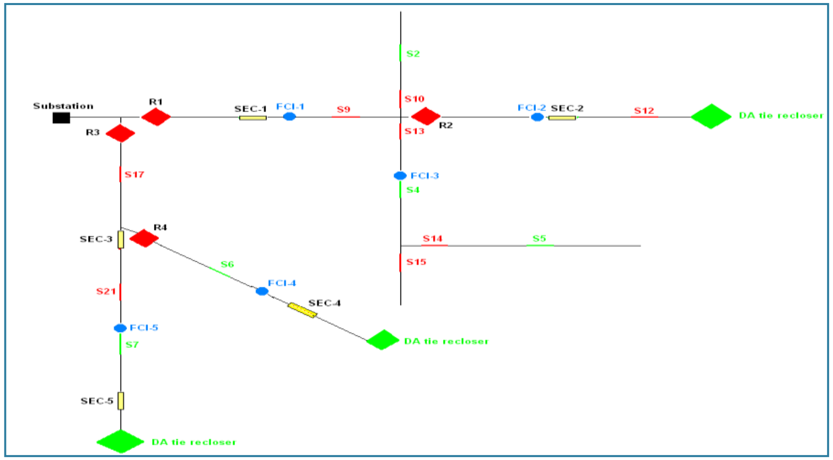
BGE®

Pilot Concept Overview - continued

Assess potential improvements from fault circuit indicators



Assess potential improvements from SCADA controlled in-line sectionalizers



Pilot Schedule and Other Considerations

- Installations should be in place before “summer” season to assess performance impacts.
- Recognize that every feeder, every application may be different, no certainty that a full package of upgrades will provide the best results
- Overall performance and results will look at cost / benefit for the level of automation and investment.
- Pilot work will also involve testing algorithms for future feeder design and performance assessments.
- Pilot proposal is for consideration. Will need to confirm availability of equipment and resources should concept be accepted.

Beyond the Pilot

- BGE will continue to work on innovations to improve system reliability and performance
  - Smart Grid Deployment
  - Distributed Automation and Voltage Control
  - RM 43 and 44 compliance
  - Other reliability enhancements
- Broad scale deployment of successful advanced strategies may require further discussion of alternate funding solutions to support the investments needed