

PROCEEDINGS

PJM Symposium on Demand Response

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Executive Summary

PJM sponsored a *Symposium on Demand Response* on May 10-11, 2007, to provide practitioners from across the region with the opportunity to discuss how to strengthen planning, analysis, and implementation of demand response (DR) programs, strategies, and techniques. The aim was to identify impediments, opportunities, and actions for expanding DR and the role it plays in the region. The federal government favors expanded DR in the region, as do the states, utilities, and customers. The primary question is how to do DR properly and cost effectively. PJM is committed to getting DR right and to making it an even more integral part of regional electric system planning and operations in the years ahead.

More than 100 people participated in the Symposium, including representatives from power companies, state and federal agencies, DR services providers, electricity customers, and PJM.¹ The discussions covered both wholesale and retail markets and addressed five main topics:

- Reasons why DR is important
- Lessons learned about DR – what works and what doesn't
- DR opportunities in the region
- Actions to address the top priority opportunities
- Next steps for moving forward

PJM is committed to getting DR right.

¹ About 90 people attended in person, 50 listened by phone. A list of attendees may be found in Appendix C.

Major Findings

- When implemented properly DR can be (1) a resource option for electricity suppliers, (2) a cost management tool for electricity customers, and (3) a mechanism for society to achieve public purposes such as environmental and consumer protection. In fulfilling these roles, optimal implementation of DR offers a variety of potential benefits, including the following:
 - Reductions in peak demand
 - Improvements in utility asset utilization
 - Improvements in electric system reliability
 - Reductions in capacity expansion and investment risks
 - More efficient and competitive wholesale market operations
 - More service options for customers
 - More ways for customers to control their electricity costs
 - Reductions in environmental emissions
 - Deployment of enabling technologies for grid modernization
- There is a vast DR experience base inside and outside the region to draw from for replicating best practices and avoiding potential pitfalls. For example, customers (not only large industrial and commercial, but also small commercial and residential) have demonstrated the ability to change their patterns of electricity consumption in response to dynamic pricing (particularly when on-peak-to-off-peak price differentials are significant) and a willingness to participate in direct load-control programs. Customer participation in wholesale DR markets has been successful in PJM and in other regions, and having able DR service providers enhances overall effectiveness. DR marketing, education, and outreach can be helpful, but these activities are often under-utilized and less effective than hoped.
- There are many opportunities for strengthening DR in the PJM region, some of which are near term and appear to require relatively little time and resources. Others are longer-term and may require significantly more time and resources. Nearer term examples include evaluating and improving PJM's existing suite of DR offerings, such as increasing the 25% cap on DR for synchronous reserves and having PJM take responsibility for metered data processing and calculation of customer baseline loads. Longer-term examples include states working more closely together to develop retail rates and DR policies that are consistent with wholesale rates and DR policies and developing consistent strategies for region-wide implementation of advanced metering infrastructure. The major opportunities for demand response are listed below:

While the level of effort and degree of coordination could be substantial, the value of potential DR benefits warrants a significant undertaking.

Major Opportunities for Demand Response

- A regional approach to the development of standardized platforms, communications protocols, investments in enabling technologies, and wholesale-retail DR integration issues
 - New retail rate structures that better reflect wholesale market pricing strategies
 - Pricing that captures the full value of DR and mechanisms for customers and service providers to get access to all relevant revenue streams
 - Direct load control for all residences, perhaps through state legislation, and modification of building codes for new residences so that they include specifications for technologies that accept/address dynamic pricing signals
 - Advanced metering infrastructure (AMI) available to all customers who want it and price responsiveness with little or no manual intervention
 - Exposure for all customers to hourly wholesale prices
 - Establishment of quantitative (MW) regional goals for DR
 - Adjustment of the 25% cap that currently exists in PJM's synchronous reserves DR program
 - Full responsibility taken by PJM for metered data and calculations used in determining customer baseline loads (CBL)
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- Action is needed to address these opportunities. While the level of effort and degree of coordination could be substantial, the value of potential DR benefits warrants a significant undertaking. For example, states need to play a stronger leadership role by making commitments to adopt DR rate designs that include dynamic pricing that is aligned with price signals from wholesale markets. The states also need to coordinate their efforts to evaluate advanced metering infrastructure and work together to develop a unified approach that includes standardized platforms and common protocols that are compatible and functionally consistent across the region. A major education and outreach campaign is needed to better understand customer needs and wants and to educate them – as well as federal and state officials and business, community, and interest group leaders – about DR offerings, costs, and benefits. Leadership and support for these actions is needed from PJM and the federal government.

Next Steps

- The major findings from this Symposium need to be communicated to several key audiences, including members of relevant PJM stakeholder committees and working groups (e.g., Members Committee, Market Implementation Committee, and the Demand Side Response Working Group) and state public utility commissioners and their staffs.
- Existing regional organizations – such as the Mid Atlantic Conference of Regulatory Utilities Commissioners and the Mid Atlantic Distributed Resources Initiative – should be utilized to communicate major findings, and these groups should be encouraged to take appropriate actions and assume necessary leadership roles.
- These efforts should be coordinated with the recently established project to encourage more national DR co-sponsored by the Federal Energy Regulatory Commission and the National Association of Regulatory Utility Commissioners. Development of new regional entities or collaborative DR processes to implement the major findings of this symposium should be avoided.

Key Themes of the PJM Symposium on Demand Response

- Consumer education on the value of DR needs to be expanded significantly.
- Retail prices need to track wholesale prices and those prices need to be communicated to consumers in a manner and at a time that allows consumers to react and reduce or defer their consumption.
- Advanced Metering Infrastructure (AMI) will be an important tool in assuring that this communication takes place and that changes in consumption are appropriately accounted for and rewarded.
- Pending deployment of AMI and other smart grid technologies, expansion of existing DR programs at the retail and wholesale levels can result in the capture of DR benefits in the short run.
- Planning for AMI deployment needs to begin today, by determining appropriate technical protocols and standards.



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1. Introduction

The PJM Symposium on Demand Response was designed to inform and involve key stakeholders in the PJM region in discussions and an exchange of views that would lead to a common understanding of demand response (DR) in the region. Through a carefully crafted process of facilitated presentations and discussion groups, participants worked together on key issues to collaboratively identify potential actions and next steps for moving forward with DR in the region.

A Symposium Planning Team guided the development of the agenda and the invitations to stakeholders. This team represented PJM, regulators, consultants, utilities, and offices of state consumer counsels. Invited participants included the following:

- Demand response subject matter experts
- State regulators
- State consumer advocates
- Retail customers
- Industrial end-use customers
- Generation and transmission owners
- Electric distributors
- Other suppliers
- Federal agencies, including the Federal Energy Regulatory Commission (FERC), the U.S. Department of Energy (DOE), and the U.S. Environmental Protection Agency (EPA)
- State departments of environmental protection

The Federal Energy Regulatory Commission is committed to encouraging and assisting in the development of demand response policies and programs, at both the wholesale and retail levels. It is a top priority for this agency.

Approximately 90 individuals representing these stakeholders attended the symposium in person, with about 50 additional persons listening via telephone. Those participating in person worked for one-and-a-half days to share their knowledge and experiences with demand response policies and programs and to identify specific actions that might be of value in crafting a demand response road map for the PJM region.

Opening remarks were presented by Audrey Zibelman, executive vice president and chief operating officer of PJM. She encouraged all attendees to think creatively to create a demand response effort in the region that involves customers as true participants in the market and that becomes a permanent feature of the PJM institutional framework.

Keynote presentations were given by Commissioner Jon Wellinghoff of the Federal Energy Regulatory Commission (FERC) and Steve Sunderhoff of Pepco Holdings Incorporated (PHI). Mr. Wellinghoff explained how FERC is approaching demand response, in particular the interaction of wholesale and retail services. He briefed the symposium participants on the recently initiated FERC-National Association of Regulatory Utility Commissioners (NARUC) demand response collaborative, which will explore these interactions.

Mr. Sunderhoff discussed PHI's effort to make the transmission and distribution system better, provide customers with greater control over their bills, mitigate prices, reduce transmission constraints, and offer energy-efficiency programs. He stressed the need to treat all market participants fairly, compensating them for responding effectively to price and energy supply issues.

Following the first round of facilitated discussions on why demand response is important in the PJM region, two luncheon speakers discussed DR from their perspectives. The first, Consumers' Counsel Janine Migden-Ostrander of the Ohio Consumers Council, encouraged participants to not leave out residential customers. Their needs and implementation requirements are critical to effective DR in the region. She stressed the need for installation of accurate and easy-to-use meters and reminded utilities and regulators to set peak prices at times that "make sense." Customer education is a critical part of effective DR in the region – all need to work together to agree on an appropriate DR message.

Commissioner Robert Lieberman, of the Illinois Commerce Commission, discussed managing risk in establishing a DR program. Risk in identifying peak demand, managing price - responsiveness, establishing proper price signals, and participation rates are all part of the insurance equation in DR. He stressed the need to share DR benefits with customers and to value DR actions properly to encourage customers to participate.





Following the luncheon, Symposium participants discussed DR best practices, barriers, and demand response opportunities. These discussions focused on significant lessons learned about what does and does not work with existing demand response in the PJM region and elsewhere. Each table provided up to five lessons of what has worked and should be replicated and five lessons of what has not worked. Identifying best practices led participants to the next session of the Symposium, which was identifying the **best** demand response opportunities in the PJM region over the short, medium, and long term. The afternoon ended with reports from each table on their deliberations and a priority-setting exercise to identify these opportunities for demand response in the region. This session resulted in nine priority opportunities for demand response, which were the focus for discussions of actions to be implemented.

Day two of the Symposium built on the discussions and priority-setting opportunities of the previous day. Symposium participants were assigned one of the top-priority DR opportunities and asked to flesh out actions that need to be implemented for each of these opportunities. Action categories included retail market; wholesale market; retail-wholesale integration; key participants and leadership roles; and key prerequisites, such as technical, regulatory, or financial.

The Symposium ended with a session to identify next steps, including gaps, overlapping ideas, and cross-cutting themes. Participants identified short, medium, and long-term steps that need to be taken and articulated their final thoughts on the findings and conclusions of the meeting.

The next section of this Proceedings document (Section 2) highlights the major findings of the discussions that took place at the Symposium – general agreement about the importance of DR to the region, lessons learned about what does and does not work with DR, top priority opportunities for strengthening DR in the region, and actions that can be implemented for making progress with the top priority opportunities.

Section 3 summarizes the results of the discussions about next steps.

Prioritized demand response opportunities and actions are listed in Appendix A. The Agenda for the Symposium is presented in Appendix B. Appendix C is a list of Symposium attendees.

2. Major Findings

The Symposium involved fifteen small-group discussions. Participants were assigned to the small groups to achieve a cross section of stakeholder perspectives from across the PJM region. For the majority of the Symposium, each small group discussed the same topics and addressed the same focus questions. Appendix A contains copies of the results produced by each of the small groups (Tables 1-15). The topics and focus questions were:

- **Importance or Value of DR in PJM Region**

- *What are the primary reasons why DR is important for electric system planning and operations and customers in the PJM region?*

- **DR Experiences and “Lessons Learned”**

- *What are the significant lessons learned about what does and does not work with existing DR in the PJM region and elsewhere?*

- **Top Priority DR Opportunities for PJM**

- *What are the best DR opportunities for the PJM region over the short, medium, and longer term to realize the benefits and fulfill the value proposition for using DR in electric system planning, operations, and customer support?*

- **Actions for Addressing the Top Priority DR Opportunities**

- *What are the most important actions that need to be implemented for the top priority DR opportunities to be brought to fruition?*

A. Importance or Value of DR in PJM Region

Demand response offers potential benefits to utilities, customers, and society at large. While it serves an important role in electric system planning and operations today, it is considered to be an underutilized resource whose value in wholesale markets is just beginning to be tapped, not only in the PJM region, but in other regional wholesale markets across the country and around the world. While many customers in the region are DR program participants in both wholesale and retail markets, the level of





understanding about program offerings and how to take advantage of them is not high and participation is not as high as it could be. The advantages of DR to society at large are the least well understood, and there is little appreciation of the role DR can play in achieving important public purposes such as environmental and consumer protection.

For electric system planning and operations, DR offers a variety of advantages for the level of utilization of utility capital assets, such as power plants and power lines, delivery of reliable electric services, addressing transmission congestion, provision of ancillary services, and management of electricity supply costs. The primary mechanism for achieving these benefits is through the reduction of peak loads, whether on an emergency basis during times of system need, or throughout the year. As a resource option in power system planning, reductions in peak load can mean delays or deferrals of generation, transmission, and distribution equipment upgrades and/or capacity expansion plans, which directly reduce capacity costs. As a tool for grid operations, peak load reductions can reduce the need for peaking capacity, and thus reduce the cost of electricity, reduce congestion on power lines, and reduce the likelihood of local problems cascading into regional outages, resulting in better reliability.

For customers, participation in DR programs provides a means for managing electricity costs. This advantage depends on the specific DR service option and the terms and conditions for curtailable and/or interruptible services. Participation in DR programs, coupled with use of distributed generation, can result in cost savings with less impact on customer operations. In certain cases, DR also gives customers more choices and greater control over their electricity consumption and electricity bills.

For society at large, expanded use of DR by utilities and customers provides the potential for several overall benefits. One area is environmental protection. Certain types of DR are known to generally reduce electricity consumption which directly translates into lower fuel consumption and lower environmental emissions. In certain instances, the use of DR displaces the use of relatively older and less efficient power plants, which can result in even lower emissions. However, it is also the case that expanded use of DR can result in higher emissions, depending on the local mix and relative cost of power generation units.

DR also provides society at large with a tool for managing potential market power problems and for protecting consumers from unnecessarily high electricity prices. DR can be used to provide a hedge against certain financial risks and for enabling wholesale electricity markets to be as openly competitive as possible. Deployment of advanced metering and other DR-enabling technologies can play a valuable role in the overall modernization of the electric grid and in ushering in a new era of “smart grid” technologies, tools, and techniques.

The advantages of DR to society at large are the least well understood, and there is little appreciation of the role DR can play in achieving important public purposes such as environmental and consumer protection.

B. DR Experiences and “Lessons Learned”

There is a vast experience base with DR programs, tools, and techniques, both inside and outside the PJM region, to draw from. One of the keys to strengthening regional DR efforts involves replicating “best practices,” avoiding pitfalls, and repeating mistakes.

Effective DR begins with the customer. Customers need to know about the available DR offerings, understand the costs and benefits of participation, and have the tools they need to respond effectively when called upon by the utility or when price signals make it economically advantageous for them to change their patterns of electricity consumption. Efforts to make participation in DR easy and “customer friendly” generally have paid off. While there is a tendency for utilities to focus on the larger industrial and commercial customer segments for DR (to get the most “bang for the buck”), small commercial and residential customers have proven to be reliable DR participants and should be included to the fullest extent that can be cost-effectively justified.

*Effective DR
begins with the
customer.*

Marketing and customer education programs can be effective, but doing it right can be costly; it is often the case that “bill stuffers,” and other traditional forms of utility-customer communications may not be enough. Mandatory programs are one way to ensure near-universal customer participation, but “command and control” style policies are not generally favored and can be counterproductive. Programs that call for customers to “opt out” rather than “opt in” represent a particularly promising approach for boosting participation.

Effective DR can involve price signals and/or direct load control. Price transparency and significant on-peak-to-off-peak price differentials have been shown to produce reliable customer responses. For example, there are many examples of large customers responding effectively to dynamic pricing; but there are also cases where small commercial and residential customers have effectively reduced peak demand in response to price signals. Recent experience with regional DR involving customer participation in wholesale markets where there is exposure to wholesale prices and fluctuations have generally been successful albeit across a limited base of customers. Having DR service providers in the market has been one of the keys to this success.

However, there has not been a great deal of success with states setting retail rates and DR offerings that are in alignment with wholesale market pricing and DR. Lack of consistency between wholesale and retail DR offerings is a critical issue that needs to be addressed more broadly in the PJM region.



Measurement, verification, and validation of customer demand responses have been significant challenges for many years, and improvements are still needed. Transparency and simplicity are paramount. “Free riders” and “gaming” need to be kept to a minimum as they undermine the efficacy of DR and its credibility as a resource option that can be “dispatched” on equal and consistent terms with supply-side resources.

Having customers “see the price signals” can occur at a variety of levels of granularity and with a variety of levels of sophistication in deployment technology. DR could be even more effective if advanced metering, communications, and control systems could be universally implemented. Achieving standardized platforms and protocols and consistent functionality in these systems across the region is a difficult challenge to address; doing so requires higher levels of coordination among the states than have been seen before. Leadership is needed to move forward on advanced metering infrastructure (AMI). The federal government is supportive and views AMI as an enabling technology for the development and deployment of a wide array of “smart grid” and grid modernization technologies, tools, and techniques.

Price transparency and significant on-peak-to-off-peak price differentials have been shown to produce reliable customer responses.

C. Top Priority DR Opportunities

There are many opportunities for strengthening DR in the PJM region, some of which are near term and appear to require relatively little time and resources, while others are longer term and may require significantly more time and resources. Nearer-term opportunities involve making incremental improvements to the existing suite of PJM’s DR offerings, as well as to those of the states in the region. Longer-term opportunities involve the development and deployment of new DR programs, strategies, tools, and techniques.

In the near term, there is an opportunity to get more customers to participate in existing DR programs and to expand dynamic pricing to more customer classes, at both wholesale and retail levels. Increasing participation could involve changing customer-incentive payments and/or doing a more comprehensive job of marketing, outreach, and customer education. It also involves evaluation of legacy programs and developing strategies for modernizing them and making them more attractive to a broader set of customer types and classes. Opportunities exist for making these programs attractive to customers by having more flexible cutoff dates, more operations, and batch process exemptions. Expanding dynamic pricing could include setting wholesale prices at the node level instead of the zonal level to increase the transparency of price signals and having the states review rate designs and include more options for time-varying rates.

Lack of consistency between wholesale and retail DR offerings is a critical issue that needs to be addressed more broadly in the PJM region.

In the near term there is room for improvement with the settlement process for existing wholesale DR market participants and in the processes for determining compliance and the amounts of load reductions. This could require greater standardization of meter data submissions.

In the longer term there is an opportunity to address advanced metering technologies and explore ways to get them universally applied or at least available to all customers who want them. There is a vision in the industry of the “smart grid,” which involves the integration of information and communications technologies with every facet of electric system operations, including generation, transmission, distribution, and end-use. Advanced metering is seen as an enabling technology that underpins a larger grid-modernization effort. Achieving this vision, which is supported by the federal government and many of the key stakeholder organizations in the industry, requires substantial coordination, collaboration, commitment, and resources. It is hard to imagine DR reaching its full potential, or being able to provide the full suite of benefits to the electric system, customers, and society, without development and widespread deployment of advanced metering infrastructure and smart grid systems.

Specifically, the top priority opportunities for DR in the PJM region include the following:

- A regional approach to the development of standardized platforms, communications protocols, investments in enabling technologies, and wholesale-retail DR integration issues
- New retail rate structures that better reflect wholesale market pricing strategies
- Pricing that captures the full value of DR and mechanisms for customers and service providers to get access to all relevant revenue streams
- Direct load control for all residences, perhaps through state legislation, and modification of building codes for new residences so that they include specifications for technologies that accept/address dynamic pricing signals
- Advanced metering infrastructure (AMI) available to all customers who want it and price responsiveness with little or no manual intervention
- Exposure for all customers to hourly wholesale prices
- Establishment of quantitative (MW) regional goals for DR
- Adjustment of the 25% cap that currently exists in PJM’s synchronous reserves DR program
- Full responsibility taken by PJM for metered data and calculations used in determining customer baseline loads (CBL)

D. Actions for Addressing the Top Priority DR Opportunities

Actions are needed to address the opportunities and strengthen DR in the PJM region. The level of effort to do so would be substantial, as would the degree of collaboration and coordination within and among the states in the region. However, the value of DR to utilities, customers, and society, and the magnitude of potential benefits, warrant a significant undertaking.

A number of specific activities, as shown in Appendix A, will be required to address the top priority actions. Many of the identified activities cross cut the various top priority DR opportunities. These activities involve three main themes: **leadership, education, and analysis.**

A new level of leadership is needed that involves all of the relevant stakeholders. Leadership is needed in every state to conduct a review of DR policies, rate designs, and program offerings, to modernize legacy programs, and to implement new, dynamic pricing policies that are consistent with wholesale price signals. This will require action from public utility commissions and possibly, state legislatures.

Leadership will be also needed from the community of DR service providers. This is an emerging industry that is still in its infancy. DR providers can assume an important role in regional DR markets, in working with customers to spur participation in DR programs and responses to DR price signals and incentives.

To achieve greater consistency of DR policies and programs among the states in the region, and between the states and PJM, broad-based leadership is needed to encourage formation of a “multi-state compact,” or some other form of regional coordination, to establish principles, policies, and guidelines for harmonizing state and regional DR efforts. Leadership from the Federal Energy Regulatory Commission, U.S. Department of Energy, and U.S. Environmental Protection Agency in support of such an effort could provide a much needed catalyst for coordinating state efforts. Actions by state legislatures, and perhaps the U.S. Congress, may also be required. Consideration of this need by senior management at PJM, relevant PJM stakeholder committees and working groups will be needed. The ultimate aim is to establish (1) a stable market and policy environment; (2) revenue streams that are relatively consistent and predictable; and (3) a long-term regional commitment so that DR markets and business models can develop and flourish.

. . . a substantial new commitment of education, marketing, and outreach is needed.

Leadership from utilities, particularly in the area of advanced metering and smart grid technologies, is also important. Advanced metering infrastructure is a complex and controversial topic. There is general agreement that progress is needed, but there are many

different points of view about how to proceed. Some are concerned about making premature decisions and prefer to wait until suppliers settle on common protocols, platforms, and functional requirements. Others believe the time is now to move forward with large-scale deployment. Leadership is needed to determine which aspects can be implemented immediately and to ensure that system designs are flexible and can accommodate changing technologies and potential new requirements for expanded functionality. Support from state utility commissions will be needed to assure utilities that their investments in AMI will be recovered.

To support these leadership actions, a substantial new commitment to education, marketing, and outreach is needed. The principal target will be customers (industrial, commercial, and residential) across the region. This campaign needs to involve two-way information flow, both to improve understanding of customer needs and wants with respect to DR, and to explain – in clear and simple terms – the value of DR and the costs and benefits of participation. A second, but no less important, audience will be policy makers and business decision makers from across the region. Elected and appointed officials, government executives and their staffs, business leaders, and leaders from environmental and public interest groups need to have a better understanding of DR, how it works, the costs and benefits, and the relative merits of alternative approaches. Traditional utility-customer communications techniques need to be augmented for this education and outreach effort to be effective.

The aim is to develop DR as a resource for electric system planning and operations so that it can be evaluated on an equal and consistent basis with supply-side resources.

Action is needed in the analysis of DR and in the development of standard methods of reporting and valuation of DR costs and benefits. The aim is to develop DR as a resource for electric system planning and operations so that it can be evaluated on an equal and consistent basis with supply-side resources. Better data and methods on DR costs and load shape impacts are needed for this to occur. Analysis of the DR value proposition for customers needs to be expanded to include the implications of using dynamic pricing at the retail level for different customer types and classes.

E. Key Themes

The key themes of the PJM Symposium on Demand Response were the following:

- Consumer education on the value of DR needs to be expanded significantly.
- Retail prices need to track wholesale prices and those prices need to be communicated to consumers in a manner and at a time that allows consumers to react and reduce or defer their consumption.



- Advanced Metering Infrastructure (AMI) will be an important tool in assuring that this communication takes place and that changes in consumption are appropriately accounted for and rewarded.
- Pending deployment of AMI and other smart grid technologies, expansion of existing DR programs at the retail and wholesale levels can result in the capture of DR benefits in the short run.
- Planning for region wide AMI deployment needs to begin today, by determining appropriate technical protocols and standards.

3. Next Steps

Symposium participants generally agreed on the value and importance of DR to the region and on what is generally needed to expand and strengthen DR's role. At the same time, it was recognized that there are significant challenges to address. Among them is the difficulty of coordinating numerous state policies and procedures into one cohesive regional policy and program. Regulatory policies, utility programs, legislation, business and industry issues, and consumer needs differ from state to state; to integrate them with the needs of other states will require significant coordination and compromise.

Looking ahead to next steps requires leadership in the integration of retail demand resources with the wholesale market. This integration challenge was a key rationale for PJM to host this Symposium. All in attendance recognized the importance of this coordination challenge, and to the effort that will be needed to address it.

Leadership on DR will involve all stakeholders in the region – from consumers to regulators, businesses to utilities and more. Since all in attendance understood that successful DR will depend on better knowledge, communications, and political will, the immediate next step is to communicate the major findings from this Symposium to several key audiences, including members of relevant PJM stakeholder committees and working groups (e.g., Members Committee, Market Implementation Committee, and the Demand Side Response Working Group) as well as state public utility commissioners and their staffs.

To improve the knowledge of DR throughout the region, existing regional organizations – such as the Mid-Atlantic Conference of Regulatory Utilities Commissioners and the Mid Atlantic Distributed Resources Initiative – should be utilized to communicate major findings, and these groups should be encouraged to take appropriate actions and assume necessary leadership roles.





And finally, more successful demand response in the region can benefit from closer coordination with national DR efforts. Toward this end, there is a need to coordinate regional with federal DR activities at the U.S Department of Energy, U.S. Environmental Protection Agency, and the recently established collaborative dialog on DR involving the Federal Energy Regulatory Commission and the National Association of Regulatory Utility Commissioners.

Appendix A: Notes from Tables 1-15

The following tables reflect the discussions held at each of 15 groups or tables of Symposium participants. Day 1 results include answers to three focus questions:

- Why is demand response important in the PJM region?
- What key lessons have been learned? What has worked? What has not worked?
- What are the best demand response opportunities in the region?

Each table reported the results of their deliberations, shown below as Day 1 tables. Participants prioritized the demand response opportunities at the end of Day 1 and discussed implementing actions for the top vote-getting demand response opportunities. Since there were two fewer tables of participants on Day 2, 13 Day 2 table results are shown below.

For Day 2, each of the 13 tables focused on one top priority opportunity, and recommended specific actions to implement that opportunity, including the following:

- Retail market actions
- Wholesale market actions
- Retail-wholesale integration actions
- Key participants and leadership roles
- Key prerequisites

Table 1 – Day 1

WHY DEMAND RESPONSE IS IMPORTANT IN THE PJM REGION	KEY LESSONS LEARNED – WHAT WORKS	KEY LESSONS LEARNED – WHAT DOESN'T WORK	BEST DEMAND RESPONSE OPPORTUNITIES
<ul style="list-style-type: none"> • Reduce customer costs – social and private benefits • Reduce price volatility → spurs economic investment and development • Reliability <ul style="list-style-type: none"> – Operational – System planning – Distribution reliability • Market power discipline • Customer empowerment – interact and express choices and control bills • Environmental – net reduction and overall efficiency 	<ul style="list-style-type: none"> • Application of new technologies that increasingly automate DR • Increasing revenue opportunities for DR at the wholesale level • Risk/reward for DR in PJM's capacity market • Recognition that different retail market segments – need different DR products – more work still needed (red globe) • Serious examination of AMI underway 	<ul style="list-style-type: none"> • Keynes vs. von Hayek • Ambitious targets but mandate DR capability to customers can choose • Too many customers still don't see market-based pricing • Some utilities see DR as a revenue risk • Cultural (regulatory and utility) discomfort with putting customers in control • High transaction costs for CSPs to bridge retail rates to wholesale market DR participation • DR is a fragmented story <ul style="list-style-type: none"> – Pricing – New transmission lines – Environmental benefit? 	<ul style="list-style-type: none"> • Integrate wholesale DR with complex retail tariffs (Long-term) <ul style="list-style-type: none"> ◆◆◆◆◆◆◆◆◆◆ • Develop and implement down market products, i.e., smart thermostats Price signal devices <ul style="list-style-type: none"> ◆ • Increase penetration of DR products for office buildings (CHP, thermo storage, energy management) (Mid-term) <ul style="list-style-type: none"> ◆ • Initiate education program of smart grid vision and associated issues, i.e., AMI costs/constraints (Short-term)

◆ = Votes

Table 1 – Day 2 - Selected Top Vote-Getting DR Opportunity

Mandatory Direct Load Control for All Residences by State Legislation with the Possibility for Mandatory Building Codes for New Residences with Technologies that Reflect Better Pricing Signals

RETAIL MARKET ACTIONS	NEW WHOLESALE MARKET ACTIONS	NEW RETAIL-WHOLESALE INTEGRATION ACTIONS	KEY PARTICIPANTS AND LEADERSHIP ROLES	KEY PREREQUISITES
<ul style="list-style-type: none"> Restructure or identify rate structures or incentives Develop valuation technique for benefits to compensate participants and CSP → virtual peaker Ensure distribution valve is captured 	<ul style="list-style-type: none"> Develop verification methodologies for new d/c technologies 	<ul style="list-style-type: none"> Current pilot for non-interval meter customers to develop M&V methodologies 	<ul style="list-style-type: none"> State policy makers Utilities PJM CSP Consumer groups/business groups 	<ul style="list-style-type: none"> Ambitious (vast and difficult) education process Industry-wide unified commitment to broad education

Table 2 – Day 1

WHY DEMAND RESPONSE IS IMPORTANT IN THE PJM REGION	KEY LESSONS LEARNED – WHAT WORKS	KEY LESSONS LEARNED – WHAT DOESN'T WORK	BEST DEMAND RESPONSE OPPORTUNITIES
<ul style="list-style-type: none"> • Utility perspective: peak demand drives everything. If mitigate peak, gain flexibility on resources, lower investment • DR mitigates transmission congestion, so may defer transmission upgrades, investment, etc. • Mitigates potential market power/abuse (DR may keep generator from withholding generation to drive up market price) • Gives customers more tools to control energy usage/costs. Can benefit all customers by providing price signals • Provides environmental benefits by deferring operation of the less-efficient units 	<ul style="list-style-type: none"> • Demand Response is not ubiquitous • Programs that involve real price signals communicated to the end-user work • The stronger the signal the stronger the response (i.e., non-PJM; Alberta) • Residential customers can be far more responsive than we give them credit for (dispatchable in 50 sec) • Customer realization of value • Education, in the context of other things • SIMPLICITY 	<ul style="list-style-type: none"> • Artificial signals • Rate designs that are improperly structured <ul style="list-style-type: none"> - Lack of clear value proposition/business models for DR providers - DSR for the sake of DSR (needs to be targeted) - Chicken & Egg (automate \leftrightarrow benefits \leftrightarrow capital investment) 	<ul style="list-style-type: none"> • For all customers implement real-time meters and rates that support real-time, TOU, or critical peak pricing ◆◆◆◆◆◆◆◆◆◆ • In addition to short-term market-based DR, include long-term contracts for DR to diversify the portfolio ◆◆◆◆◆◆ • Establish energy-efficiency resource standard with tradable white tags for verifiable and dispatchable load ◆◆◆

◆ = Votes

Table 2 – Day 2 – Selected Top Vote-Getting DR Opportunity

PJM Directly Imports Meter Data and Performs Customer Baseline Load (CBL) Calculations

RETAIL MARKET ACTIONS	WHOLESALE MARKET ACTIONS	RETAIL-WHOLESALE INTEGRATION ACTIONS	KEY PARTICIPANTS AND LEADERSHIP ROLES	KEY PREREQUISITES
<ul style="list-style-type: none"> • Create and certify meter data service providers 	<ul style="list-style-type: none"> • Encourage members to provide meter data to PJM 	<ul style="list-style-type: none"> • Open access to meter data • Chicken/egg – resolve commission hesitancy to approve individual EDC metering rollout plans <ul style="list-style-type: none"> – Create standard data formats and metering capabilities 	<ul style="list-style-type: none"> • Just Do It! • Learn from New England, New York, California • EDCs • PJM • State commission/ customers • CSPs 	<ul style="list-style-type: none"> • Create standard format for (Meter Data Service Providers) utilities to transmit meter data to PJM • Program (software) needed to perform CBL calculation • Encourage standard AMI meters for all customers

Table 3 – Day 1

WHY DEMAND RESPONSE IS IMPORTANT IN THE PJM REGION	KEY LESSONS LEARNED – WHAT WORKS	KEY LESSONS LEARNED – WHAT DOESN'T WORK	BEST DEMAND RESPONSE OPPORTUNITIES
<ul style="list-style-type: none"> • Market efficiency – economic load response → introduces slope to the demand curve • Market discipline (market power) • Some kinds of DR are well suited to supply ancillary services (like synchronized reserve) • Ability to reduce a customer's/ LSE's Contribution to Peak Load • Relieve and/or defer transmission enhancements 	<ul style="list-style-type: none"> • Demand resources are able to participate in all PJM markets • Demand resources can get LMP and are able to set market clearing price if marginal unit • Provide opportunity for CSPs and 3rd party providers to participate • Increased technical development and implementation of pilot programs at retail level 	<ul style="list-style-type: none"> • Retail demand resources needs to be integrated more with wholesale <ul style="list-style-type: none"> – Participation needs to go beyond industry • Increased coordination between wholesale and state stakeholders, i.e., utilities, advocates, utilities • Everyone needs to share the risk <ul style="list-style-type: none"> – Nobody held harmless – Cost shared – same agenda • Technical and political barriers in getting price signals to customers, i.e., jurisdictional and regulatory barriers • Increase education about PJM and retail DR opportunities 	<ul style="list-style-type: none"> • Coordinate a regional approach to DR including facilitating investment, e.g., AML, enabling tech (Long-term) <ul style="list-style-type: none"> ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆ ◆◆◆◆◆ • Facilitate wholesale – retail seams issue (Mid-term) <ul style="list-style-type: none"> ◆◆◆◆◆ • Education and facilitation of existing programs with increased coordination between state and federal/retail and wholesale entities to capture additional DR benefits (Short-term)

◆ = Votes

Table 4 – Day 1

WHY DEMAND RESPONSE IS IMPORTANT IN THE PJM REGION	KEY LESSONS LEARNED – WHAT WORKS	KEY LESSONS LEARNED – WHAT DOESN'T WORK	BEST DEMAND RESPONSE OPPORTUNITIES
<ul style="list-style-type: none"> • Price signals allow rational customer choice, which enhances market efficiency and mitigates market power • Demand response offers an environmentally benign and cost-effective alternative to new generation, fuel use, transmission expansion, and congestion • Demand response can be targeted to locations and time of greatest need (economic, reliability) • Demand response can be effective without 100% customer participation • Demand response can accommodate different customer participation costs, allowing some customers to respond greatly and others to avoid participating altogether, and others in between 	<ul style="list-style-type: none"> • Some decreased demand • Dialogue across agencies • Metering innovation • Increase in public interest and support • Education (recycling taught in schools) 	<ul style="list-style-type: none"> • Conflicting incentives (lack of) and disincentives (utility base ratio) • Impact to environment <ul style="list-style-type: none"> – Need ↑ information on resulting generation mix – Component of our quality program • No price transparency • “Sputters” in Regulated States (utility disincentive and rate structure) • Not user-friendly • Inconsistent DR programs across the country 	<ul style="list-style-type: none"> • Leverage C&I customer base to react to price signals (capacity and energy) in addition to emergency signals <ul style="list-style-type: none"> – Educate C&I to bid DR into RTO RPM (Short-term, less than 1 year) <p>◆◆◆◆◆◆◆◆◆◆</p> • Promote energy-efficient products to levelize demand curve <ul style="list-style-type: none"> – Verifiable – Measurement criteria – Term (Mid-term, 3 years) <p>◆◆◆◆◆◆◆◆◆◆</p> • Region-wide standardized platforms <ul style="list-style-type: none"> – Communication protocols – AMI deployment, including residential – Utility rate structure conducive to DR programs (Long-term, 5 years) <p>◆◆◆◆◆◆◆◆◆◆</p>

◆ = Votes

Table 4 – Day 2 – Selected Top Vote-Getting DR Opportunity

Universally-Available AMI – All Customers Implement Real-Time Meters and Rates So Customers Are Able to Respond With Little to No Manual Intervention

RETAIL MARKET ACTIONS	WHOLESALE MARKET ACTIONS	RETAIL-WHOLESALE INTEGRATION ACTIONS	KEY PARTICIPANTS AND LEADERSHIP ROLES	KEY PREREQUISITES
<ul style="list-style-type: none"> • Service provider (utility, CSP, etc.) can manage DR program • Education program (schools, utilities, CSP) • Appropriate retail rate design 	<ul style="list-style-type: none"> • Stable program with long-term commitment • Facilitate price transparency to end use customer • Integration into long-term system planning (Future Resource Commitment) 	<ul style="list-style-type: none"> • Development and implementation of appropriate industry standards (mechanical/tech.) • Open architecture <ul style="list-style-type: none"> – EDI – Meter design – Ability to capture innovation • Increase flexibility of RTO DR coordination and design to respond to differing retail regulatory models 	<ul style="list-style-type: none"> • Regulatory/legislative (PUC, RTO, FERC, Legislature) • DR delivery channel (LDCs, LSEs, CSPs, Meter Providers and RTOs) • End use customers 	<ul style="list-style-type: none"> • Open architecture <ul style="list-style-type: none"> – Economies of scale – Access • State tariffs requiring “Real-Time” rate structure • End-user ability

Table 5 – Day 1

WHY DEMAND RESPONSE IS IMPORTANT IN THE PJM REGION	KEY LESSONS LEARNED – WHAT WORKS	KEY LESSONS LEARNED – WHAT DOESN'T WORK	BEST DEMAND RESPONSE OPPORTUNITIES
<ul style="list-style-type: none"> • Reduced market power and increased price transparency for end users • Reduces peaks and reduces transmission congestion • Creates new economic opportunities <ul style="list-style-type: none"> – Service providers, “smart” appliances – Retail “storage” and other new products • Capital investment efficiency leads to improved revenues for some generation • Environmental benefits <ul style="list-style-type: none"> – Peak shaving – Shifts to more environmentally benign generation 	<ul style="list-style-type: none"> • Existence of CSPs in PJM has enhanced Demand Response • Cooperation among utility regulatory agencies can help remove barriers to investments in Demand Response 	<ul style="list-style-type: none"> • PJM Load Response Program has made great strides, e.g., CSPs, but still includes intrinsic barriers such as increasing the PLC tag • In an unbundled electricity market, the benefits of DR are dispersed among multiple entities making it difficult to put together a business case for utilities • Regulatory barriers encourage maximization of sales therefore discouraging demand-side solutions • Currently a disconnect between wholesale and retail energy markets that prevents customers from seeing and reacting to prices 	<ul style="list-style-type: none"> • Expand time-differentiated pricing to a broader array of customers in order to expand the amount of price responsiveness to load <ul style="list-style-type: none"> – Educate customers about benefits – Role of state commissions in enabling policies (Long-term) <p>◆◆◆◆◆</p> • Set wholesale pricing at the node instead of the zonal level – increasing price signals (Short-term) • Make the Load Response Program more attractive for large industrial customers to participate (Short-to-Mid-term)

◆ = Votes

Table 6 - Day 1

WHY DEMAND RESPONSE IS IMPORTANT IN THE PJM REGION	KEY LESSONS LEARNED – WHAT WORKS	KEY LESSONS LEARNED – WHAT DOESN'T WORK	BEST DEMAND RESPONSE OPPORTUNITIES
<ul style="list-style-type: none"> • Transmission constraint mitigation • Reduction in summer peak demand <ul style="list-style-type: none"> – Peak shaving to reduce scarcity • Price mitigation • Competitive wholesale market <ul style="list-style-type: none"> – Treating load response as generation • Consumer empowerment <ul style="list-style-type: none"> – Control of energy bills – Reduction in emissions during hot days – Promote efficiency 	<ul style="list-style-type: none"> • Expansion of DR opportunities <ul style="list-style-type: none"> – Customer interest/awareness increasing • Customers have responded to prices and have saved \$ • Reduced LMPs and Congestion • Subsidy/incentive <ul style="list-style-type: none"> – Increase customer participation • Evolution of enabling technology 	<ul style="list-style-type: none"> • Hard to recruit customers <ul style="list-style-type: none"> – Programs increasingly complicated • Reconciliation of state/federal juris. • Method for determining actual response <ul style="list-style-type: none"> – CBL determination – Gaming/free ridership • Subsidy/incentive and who pays for TD • Software catching up at Load Response 	<ul style="list-style-type: none"> • Universally available AMI <ul style="list-style-type: none"> – Customer receives price signals – Customer able to respond with little to no manual intervention – Mandatory real-time pricing with ability to purchase hedge option (Long-term) <p>◆◆◆◆◆◆◆◆</p> • Incentives for customers <ul style="list-style-type: none"> – Up to a threshold amount – Phased-out – With equitable socialization – Cost recovery explicitly identified and addressed by all stakeholders – Cost recovery explicitly permitted by regulators (Medium-term) <p>◆◆◆◆</p> • Establish consistent, easy-to-use programs that are fair to all stakeholders <ul style="list-style-type: none"> – At state, RTO and National level (Short- to Medium-term) <p>◆◆◆</p> • Establish economically-justified and achievable DR goals

◆ = Votes

Table 6 – Day 2 – Selected Top Vote-Getting DR Opportunity
PJM and States Work on Setting Firm DR MW Goals

RETAIL MARKET ACTIONS	WHOLESALE MARKET ACTIONS	RETAIL-WHOLESALE INTEGRATION ACTIONS	KEY PARTICIPANTS AND LEADERSHIP ROLES	KEY PREREQUISITES
<ul style="list-style-type: none"> • Education • Metering and Enabling Technology • Supporting rate structures <ul style="list-style-type: none"> – Regulated vs. competitive supplier issues 	<ul style="list-style-type: none"> • Education • Consistent long-term programs/market rules • Attractive programs that encourage participation • Integrate into wholesale market 	<ul style="list-style-type: none"> • Wholesale market design complements retail rate • Exposure to wholesale real-time market prices, either directly or indirectly • Provide mechanism for cost recovery <ul style="list-style-type: none"> – Retail, and if not there, wholesale 	<ul style="list-style-type: none"> • PJM <ul style="list-style-type: none"> – Facilitate and develop wholesale market rules – Provide analytical support • FERC <ul style="list-style-type: none"> – Uniform goal across PM • State commissions/legislature <ul style="list-style-type: none"> – Establish the goal and recovery – Oversight • Utilities/LSEs <ul style="list-style-type: none"> – Data, control centers input, participant • Consumer advocates/consumers <ul style="list-style-type: none"> – Input, participant 	<ul style="list-style-type: none"> • Agreement this is important • Economic justification <ul style="list-style-type: none"> – Costs and benefits • Feasibility <ul style="list-style-type: none"> – Market potential – Technology

Table 7 – Day 2 – Selected Top Vote-Getting DR Opportunity

Universally-Available AMI – All Customers Implement Real-Time Meters and Rates so Customers Are Able to Respond with Little to No Manual Intervention

RETAIL MARKET ACTIONS	RETAIL-WHOLESALE INTEGRATION ACTIONS	KEY PARTICIPANTS AND LEADERSHIP ROLES	KEY PREREQUISITES
<ul style="list-style-type: none"> • State PUCs need to adopt smart grid vision – AMI is platform for smart grid • Adopt systems approach – avoid investments that don't integrate • Retail rate structures need to reflect wholesale prices – i.e., default service 	<ul style="list-style-type: none"> • States need to lead/push and coordinate with ISOs and standards bodies <ul style="list-style-type: none"> – Functional requirements – Interoperability – Standards – Plug & Play – Data – who collects it, how is it exchanged, and who has access to it? 	<ul style="list-style-type: none"> • PJM <ul style="list-style-type: none"> – Facilitate – Educate – Analyze • PUCs <ul style="list-style-type: none"> – Vision and implementation driver – Business cases – Rate making • R&D community and entrepreneurs <ul style="list-style-type: none"> – Venture funds – Equity – DOE 	<ul style="list-style-type: none"> • PJM supports and facilitates education and analysis • Educate customers • Make it simple for customers • Establish investment criteria to include societal, customer, and utility benefits

Table 8 – Day 1

WHY DEMAND RESPONSE IS IMPORTANT IN THE PJM REGION	KEY LESSONS LEARNED – WHAT WORKS	KEY LESSONS LEARNED – WHAT DOESN'T WORK	BEST DEMAND RESPONSE OPPORTUNITIES
<ul style="list-style-type: none"> • Planning <ul style="list-style-type: none"> – Manage T&D additions more cost-effectively, less expensive alternative to peakers. Conservation provides environmental benefit. • Operations <ul style="list-style-type: none"> – Emergency response benefit for operational reliability – Less expensive alternative for congestion management – Provides operational diversity • Customer <ul style="list-style-type: none"> – Empowers customer to discipline market and control their expense – Rewards elasticity and flexibility – Creates awareness that efficiency is cost effective and environmentally responsible which enables aggregation of customer response 	<ul style="list-style-type: none"> • Timely price signals • Informed consumer • Benefits to all in supply chain • Supporting technology • Price matters 	<ul style="list-style-type: none"> • Lack of or poor marketing • Technology, challenged • Flat prices • Lack of cooperation • In action 	<ul style="list-style-type: none"> • PJM should dedicate sufficient resources to market and educate customers on current DR programs ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆ • Achieve alignment between FERC, RTO, and states ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆ • Install the technology currently available to make price signals work ◆◆

◆ = Votes

Tables 8 and 11 – Day 2 – Selected Top Vote-Getting DR Opportunities

Better Reflect Wholesale Market Trends; Encourage New Rate Structures at the Retail Level by Integrating Wholesale DR with Complex Retail Tariffs

RETAIL MARKET ACTIONS	WHOLESALE MARKET ACTIONS	RETAIL-WHOLESALE INTEGRATION ACTIONS	KEY PARTICIPANTS AND LEADERSHIP ROLES	KEY PREREQUISITES
<ul style="list-style-type: none"> Revenue decoupling Cost recovery to reflect system benefits (e.g., the value of reduction of greenhouse gas emissions) Revise/modify/replace legacy tariffs Provide greater choices to retail customers and inform them of those choices 	<ul style="list-style-type: none"> Allocate DR costs to those receiving the benefit Define the operational characteristics of DR products 	<ul style="list-style-type: none"> Market the benefits of DR to state stakeholders Encourage/have states clearly define their level of demand response (example, establish a master demand response plan) 	<ul style="list-style-type: none"> Encourage new rate structures Public utility commissions RTOs Utilities/curtailment service provider/consumer advocates/environmental regulators 	<ul style="list-style-type: none"> Active public education program Public acceptance Wholesale DR product criteria

Table 9 – Day 1

WHY DEMAND RESPONSE IS IMPORTANT IN PJM REGION	KEY LESSONS LEARNED – WHAT WORKS	KEY LESSONS LEARNED – WHAT DOESN'T WORK	BEST DEMAND RESPONSE OPPORTUNITIES
<ul style="list-style-type: none"> • DR makes markets more competitive • DR allows customers to manage their energy cost • DR can enhance system reliability • DR can defer new transmission and/or generation investment (planning) • DR can help in operations through diversity of resources (i.e., 10-min. reserves) • DR can provide environmental benefits 	<ul style="list-style-type: none"> • Economic load response program <ul style="list-style-type: none"> – Difficult to quantify system savings – Exposure to spot market for fixed price customers • ALM • Synchronous reserves (lots of participation) • Wholesale spot price → retail rates → bill (see diagram) 	<ul style="list-style-type: none"> • Load participating in the regulation market <ul style="list-style-type: none"> – Enabling technology not available (to regulate the load) • Getting a universally accepted baseline calculation is problematic • Demand response or “spring break”? (see diagram) 	<ul style="list-style-type: none"> • Gain consensus on measuring system-wide benefits of DR <ul style="list-style-type: none"> – Financial – Environmental – Other <p>◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆</p> • Expedite DR settlement process by standardizing meter data submittals of utilities (when in doubt → blame the utilities” (Short-term) <p>◆◆◆◆◆</p> • Bundle uplift charges into LMP to reflect true DR savings for load reduction (Long-term) <p>◆◆◆◆◆</p> • Complex retail tariffs • Faster meter data submittals • Old meter technology • IMP

◆ = Votes

Table 9 – Day 2 - Selected Top Vote-Getting DR Opportunity
 Demand Response Able to Get Access to All Revenue Streams or a
 Price that Captures Full Value

RETAIL MARKET ACTIONS	WHOLESALE MARKET ACTIONS	KEY PARTICIPANTS AND LEADERSHIP ROLES	KEY PREREQUISITES
<ul style="list-style-type: none"> • None • “The Great Debate” 	<ul style="list-style-type: none"> • Include in DSR payments any savings beyond energy (LMP) <ul style="list-style-type: none"> – Pay operating reserves costs in addition to LMP 	<ul style="list-style-type: none"> • PJM stakeholder process <ul style="list-style-type: none"> – DSRWG – MIC – MC • Agreement to ongoing debates: <ul style="list-style-type: none"> – Incentives vs. no incentives 	<ul style="list-style-type: none"> • New technology for load to participate in the regulation market • Need to establish “full value” of DSR

Table 10 – Day 1

WHY DEMAND RESPONSE IS IMPORTANT IN THE PJM REGION	KEY LESSONS LEARNED – WHAT WORKS	KEY LESSONS LEARNED – WHAT DOESN'T WORK	BEST DEMAND RESPONSE OPPORTUNITIES
<ul style="list-style-type: none"> • Reduces capital investment <ul style="list-style-type: none"> – Potential to replace small peaking unit • Grid operations and reliability <ul style="list-style-type: none"> – Future congestion management plan for DSR gives transmission operators more control • Deemphasizes mitigation and scarcity pricing situations • As capacity shortages increase, DSR becomes increasingly more valuable • Empowers customers to make decisions <ul style="list-style-type: none"> – Customer needs vary 	<ul style="list-style-type: none"> • Residential customers will participate • Increase incentive = increase participation • Pricing with direct load control is more effective in reducing peak demands • Time of use rate customers did better with direct load control because of better education • Have well-thought-out processes and infrastructure prior to implementation <ul style="list-style-type: none"> – Devil in the details – Metering and validation 	<ul style="list-style-type: none"> • Spread is not significantly sufficient to inspire participation • Lots of man-hours to verify the correct values in the bill • Lack of transparency to market prices for CSPs and customers • Misalignment with current energy market may be less successful • No moral obligation to utilities • Lack of metering and validation • Voluntary programs reward free riders • Empowering consumers to make informed decisions • “AMI means friend” 	<ul style="list-style-type: none"> • Mandatory direct load control for all residents by state legislation. Subset: Mandatory building codes for new residential homes with technology that reflects better pricing signals. Alt: Opt Out ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆ • Non-industry market drivers providing new technologies to provide new options for DSR (Long-term) ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆ • Fine-tune the current process to get the “low-hanging fruit” (Short-term) ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆ • Energy-efficiency programs and conservation compliments DR (Mid-term) ◆

◆ = Votes

Table 10 – Day 2 – Selected Vote-Getting DR Opportunity
Expose All Customers to Hourly Wholesale Prices

RETAIL MARKET ACTIONS	WHOLESALE MARKET ACTIONS	RETAIL-WHOLESALE INTEGRATION ACTIONS	KEY PARTICIPANTS AND LEADERSHIP ROLES	KEY PREREQUISITES
<ul style="list-style-type: none"> • Deploy meters • Educate the customers • Getting rate structure in place (define it in the tariff) • Ensure consumers see all of the benefits • Address decoupling issues 	<ul style="list-style-type: none"> • Ensure that DSR resources are able to participate at the same level generation resources • Operational load forecasts needs to be done to include DSR • Re-evaluate existing wholesale framework <ul style="list-style-type: none"> – Unintended consequences – DA vs. RT – Free riders 	<ul style="list-style-type: none"> • Communication of prices to customers • PJM → EDC/LSE → Customers (see diagram) 	<ul style="list-style-type: none"> • Utilities • Legislation/policy makers • Consumer groups/advocates • Software vendors/appliance makers • Unions • Press 	<ul style="list-style-type: none"> • Is hourly price to be R-T or DA or both? • Signals and billing need to agree • How to reconcile that customers are exposed to R-T prices yet suppliers actually buy power on a portfolio basis • AMI • Definition of hourly wholesale prices • Default service (SOS) to all customers

Table 11 – Day 1

WHY DEMAND RESPONSE IS IMPORTANT IN THE PJM REGION	KEY LESSONS LEARNED – WHAT WORKS	KEY LESSONS LEARNED – WHAT DOESN'T WORK	BEST DEMAND RESPONSE OPPORTUNITIES
<ul style="list-style-type: none"> • Reduces congestion • Reduces need for infrastructure • Reduces emissions • Lower overall cost to the customer via their bills • Increased reliability due to additional resources • Shift risk from consumers to others who can better manage 	<ul style="list-style-type: none"> • Reduce barriers to participate <ul style="list-style-type: none"> – Clear view of participant value – Customer education and programmatic support • Economics, technology and regulation: 3-legged stool • Stable regulatory horizon <ul style="list-style-type: none"> – Consistent business rules – $\Delta = \text{Risk} = \text{cost} + \text{indecision}$ • Make customers a partner in the process • Real-time hourly priced programs for larger customers 	<ul style="list-style-type: none"> • Limited market size does not achieve critical mass • Retail competition does not create new demand response products; program is inconsistent with reducing load • Lack of long-term commitment to programs, financial, regulatory, political • Expensive front-end costs to participate • Participant opaque or unfriendly program interface, time-of-use metering doesn't allow customer to see cost of behavior in real-time 	<ul style="list-style-type: none"> • Peak period government shut down ◆◆◆◆◆ • Deploy enhanced PJM demand response program ◆◆ • AMI ◆

◆ = Votes

Table 12 – Day 1

WHY DEMAND RESPONSE IS IMPORTANT IN THE PJM REGION	KEY LESSONS LEARNED – WHAT WORKS	KEY LESSONS LEARNED – WHAT DOESN'T WORK	BEST DEMAND RESPONSE OPPORTUNITIES
<ul style="list-style-type: none"> • Load shifting DR → lower peak <ul style="list-style-type: none"> – Lowers wholesale market prices • Costs <ul style="list-style-type: none"> – G – lower cost of generation – use base load – T- lower cost of transmission, less congestion – D – lower cost of distribution – Less investment in new generation – Improves load factor of system • Dispatchable DR (e.g., interruptibles)/emergency <ul style="list-style-type: none"> – Improve reliability of overall system • EE DR <ul style="list-style-type: none"> – Reduce consumption, reduce bills, environment 	<ul style="list-style-type: none"> • CSPs – facilitators and innovators • DR programs – “existence” drives innovation • State programs that allow participation (i.e., NJ) • DR programs have driven price sensitivity among larger customers/ enhanced use of on-site generation 	<ul style="list-style-type: none"> • States/utilities “some” preclude participation in LRPs • CBL <ul style="list-style-type: none"> – Customer baseline rules – Correct measurement? • Where does state jurisdiction end and FERC jurisdiction begin? • Three different agendas – LSES, EDC, CSP 	<ul style="list-style-type: none"> • Increase 25% cap on SR (Synch. Reserve) by DR. Prepare report on performance to date. Present to OC/MIC (Short-term) <p style="text-align: center;">◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆</p> <p style="text-align: center;">◆◆◆</p> • Not only AMI but (1) Also standardized data protocols. (2) Open standards, open access for Auration. Matches DR offerings <p style="text-align: center;">◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆</p> • Inject regulatory certainty into LR programs so as to facilitate longer-term trading of DR products via a FERC process and work out details via stakeholder processes <p style="text-align: center;">◆◆◆◆◆◆◆</p>


◆ = Votes

Table 12 – Day 2 – Selected Top Vote Getting DR Opportunity

Coordinate a Regional Approach to DR Through Standardized Platforms, Communications Protocols, Investments in Enabling Technologies, and Addressing Seams Issues

RETAIL ACTIONS	WHOLESALE MARKET ACTIONS	RETAIL-WHOLESALE INTEGRATION ACTIONS	KEY PARTICIPANTS AND LEADERSHIP ROLES	KEY PREREQUISITES
<ul style="list-style-type: none"> Interstate compact to facilitate state participation (AH – MOU among states?) Establish process to develop open protocol and open standard “Enabling Technologies” AMI mandate use of standard for DR., but allow market to deploy 	<ul style="list-style-type: none"> Phase-out of ELRP “incentive” TBD When we reach “utopia” of D elasticity, operators must learn to anticipate P element of load curves 	<ul style="list-style-type: none"> See 1 and 2 	<ul style="list-style-type: none"> States in PJM region (PUCs, legislatures, governors) FERC PJM management and stakeholders “It’s disruptive, but it will work” 	<ul style="list-style-type: none"> State interest/motivation FERC approval of market rule changes

Table 13 – Day 1

WHY DEMAND RESPONSE IS IMPORTANT IN THE PJM REGION	KEY LESSONS LEARNED – WHAT WORKS	KEY LESSONS LEARNED – WHAT DOESN'T WORK	BEST DEMAND RESPONSE OPPORTUNITIES
<ul style="list-style-type: none"> • Tool for mitigating market power • Utility cost reduction and better connection to end use customer individual address ability • Empower consumers • Local reliability benefits • Reduce emissions • Short-term bridge to bulk transmission and generation construction 	<ul style="list-style-type: none"> • Price signals • Keeping it simple to the DR resource (customer) • Transition period for changes • Risk/reward profile has to be positive for customer • Patience with customers as they adjust • Voluntary, easy to use, education works 	<ul style="list-style-type: none"> • Price signals • Traditional interruptible services tariffs <ul style="list-style-type: none"> – Economic development (wink wink) • Pilot programs – no certainty, no investment • One size fits all • Forcing customers into anything works 	<ul style="list-style-type: none"> • Demand Response able to get access to all revenue streams or a price that captures full value <div style="text-align: center; margin-top: 5px;">  </div> • 1-minute reserves (Short-term) • Load as regulation (Medium-term)

◆ = Votes

Table 13 – Day 2 – Selected Top Vote-Getting DR Opportunity

Demand Response Able to Get Access to All Revenue Streams or a Price that Captures Full Value

RETAIL MARKET ACTIONS	WHOLESALE MARKET ACTIONS	RETAIL-WHOLESALE INTEGRATION ACTIONS	KEY PARTICIPANTS AND LEADERSHIP ROLES	KEY PREREQUISITES
<ul style="list-style-type: none"> Retail rates must reflect allocation of DR costs to beneficiaries Reflect distribution feeder costs in establishing retail contribution to DR Retail rate structures that equalize the value of energy supply and DR 	<ul style="list-style-type: none"> Compare and quantify benefits of DR and potential revenue streams to those benefits (i.e., environmental, future investment, ancillaries) Standardize performance metrics for DR to increase confidence in reliability Allocate costs of DR to beneficiaries Get “Turned On” by turning off 	<ul style="list-style-type: none"> Take nodal pricing down to a distribution substation level 	<ul style="list-style-type: none"> CSPs need to step up and accept risks LSEs need to open door to allow greater volume of DR to allow value to occur State regulators to take regulatory actions needed to enable platform for DR commerce 	<ul style="list-style-type: none"> Regulatory support at levels Proper metering/ measurement/ communication standards Erode bias towards iron in the ground

Table 14 – Day 1

WHY DEMAND RESPONSE IS IMPORTANT IN THE PJM REGION	KEY LESSONS LEARNED – WHAT WORKS	KEY LESSONS LEARNED – WHAT DOESN'T WORK	BEST DEMAND RESPONSE OPPORTUNITIES
<ul style="list-style-type: none"> • More people in high places are talking about DR as a policy initiative • Opportunity of new technology to be developed • Change to thinking of electricity as a service with options – more than flipping a switch • DR changes customer perception from “as much as you want/when you want/at low prices” • DR lightens stress in infrastructure (T&D) • Opportunity for economic development <ul style="list-style-type: none"> – Energy management services – Distributed generation (fuel vs. electric price choices) 	<ul style="list-style-type: none"> • Customer can make economic decision – self schedule • Ability to participate in multiple markets (energy –RT, DA, capacity, synch reserve, reg.) → can align opportunity with customer capability (notification, duration, frequency, etc.) • DG can easily respond to price (behind the meter generation gets similar access to wholesale market) 	<ul style="list-style-type: none"> • Fixed rates and non-interval meters • Some load can not respond at any price • Settlement disputes <ul style="list-style-type: none"> – Difference between expected and actual payments • Free-ridership/gaming • Environmental issues with DG (lawn mower example) • Consensus on funding of incentive • Complexity for smaller loads • Demand response done for expected LMP (2 months from now) – plant shutdown • Consistent interpretation of rules to support participants • “Knowledge is Power” you need information to be smart! 	<ul style="list-style-type: none"> • Offer new program for customers to change plant/office shutdown to pre-determined periods/integrate into plug process (Short-term) <ul style="list-style-type: none"> ◆◆◆◆◆ • More flexible load management program (DR/ILR) <ul style="list-style-type: none"> – More flexible cutoff dates – More operations for events/duration/times – Batch process exemption ◆◆◆ • Long term <ul style="list-style-type: none"> – Smart meter – Repository for data – RTP ◆◆ • Resolve B/O generation permit issues that limit emergency operation only (Medium-term) <ul style="list-style-type: none"> ◆

◆ = Votes

Table 14 – Day 2 – Selected Top Vote-Getting DR Opportunity

Coordinate a Regional Approach to DR Through Standardized Platforms, Communications Protocols, Investments in Enabling Technologies, and Addressing Seams Issues

RETAIL MARKET ACTIONS	WHOLESALE MARKET ACTIONS	RETAIL-WHOLESALE INTEGRATION ACTIONS	KEY PARTICIPANTS AND LEADERSHIP ROLES	KEY PREREQUISITES
<ul style="list-style-type: none"> Standardized meter-level information Standardized information flow/communications. Standardized switch/controls down to end use level Open access to information 	<ul style="list-style-type: none"> Standardized "Price Transactions" Automated access to data 	<ul style="list-style-type: none"> Enabling technology – load control Expand retail level standards to wholesale level 	<ul style="list-style-type: none"> Wholesale: PJM "CSP" type entities Retail: <ul style="list-style-type: none"> – Commission – EDC – ESP/LSE 	<ul style="list-style-type: none"> Stakeholder agreement EDC, ESP, PJM/FERC, commissions, DOE Lead with protocol, follow with technology

Table 15 – Day 2 – Selected Top Vote-Getting DR Opportunity

Increase 25% Cap on Synchronous Reserve by DR. Prepare a Report on Performance to Date.
Present to OC/MIC

RETAIL MARKET ACTIONS	WHOLESALE MARKET ACTIONS	RETAIL-WHOLESALE INTEGRATION ACTIONS	KEY PARTICIPANTS AND LEADERSHIP ROLES	KEY PREREQUISITES
<ul style="list-style-type: none"> • Same as retail – Wholesale integration action • Table 15 – Discussed the impacts of the 25% cap on synchronous reserve by demand response. Concluded that the 25% cap should be reassessed or appropriateness and changes made accordingly. 	<ul style="list-style-type: none"> • PJM creates report on load response synchronous reserves performance versus generator synchronous reserve performance • PJM presents report to RFC and makes a recommendation. RFC determines the appropriateness of 25% cap. 	<ul style="list-style-type: none"> • Where appropriate, retail tariffs need to be restructured to accommodate participation in synchronized reserve markets 	<ul style="list-style-type: none"> • PJM: Develop report and make necessary recommendations and filings • Reliability Organizations: Review PJM filings and reports; adjust cap accordingly, and approve • FERC: Approve filings 	<ul style="list-style-type: none"> • All states need to allow participation in PJM load response • ERO must adopt changes in reliability standards directed by FERC

Appendix B: Agenda

PJM Symposium on Demand Response AGENDA

Date/Time	Activity	Host/Location
Wed., May 9, 2007	Primer on Demand Response (DR)	Hilton Alexandria at Mark Center
1:00 - 5:00 p.m.	Pre-symposium training session on DR at PJM and an overview of activities from MADRI and MWDRI	<ul style="list-style-type: none"> ⌚ Dennis Regan, Senior Trainer, PJM ⌚ Brad Johnson, ACN Energy Ventures ⌚ Commissioner Robert Lieberman, ICC
Thu., May 10, 2007	Day 1	Hilton Alexandria at Mark Center
7:00 - 9:00 a.m.	Continental Breakfast and Registration	Hilton Alexandria at Mark Center
9:00 a.m. - noon	Opening Remarks & Event Overview	<ul style="list-style-type: none"> ⌚ Audrey Zibelman, EVP and COO, PJM ⌚ Rich Scheer, Vice President, Energetics Incorporated
	Keynote Presentations	<ul style="list-style-type: none"> ⌚ Commissioner Jon Wellinghoff, FERC ⌚ Steve Sunderhoff, PHI
	Session 1: <i>What Is DR and Why Is It Important?</i>	Discussion facilitated by Energetics*
Noon - 1:30 p.m.	Lunch - <i>DR from the State Perspective</i>	<ul style="list-style-type: none"> ⌚ Commissioner Robert Lieberman, ICC ⌚ Consumers' Counsel Janine Migden-Ostrander, OCC
1:30 - 5:00 p.m.	Session 2: <i>Best Practices, Barriers to Overcome, and Priority DR Opportunities</i>	Discussion facilitated by Energetics*
5:30 - 7:00 p.m.	Reception	Hilton Alexandria at Mark Center
Evening	Dinner	Dinner on own



Fri., May 11, 2007	Day 2	Hilton Alexandria at Mark Center
7:00 - 8:00 a.m.	Continental Breakfast	Hilton Alexandria at Mark Center
8:00 a.m. - noon	Session 3: <i>Building the DSR Roadmap (Retail, Wholesale and Integration)</i>	Discussion facilitated by Energetics*
Noon - 1:00 p.m.	Working Lunch	Discussion facilitated by Energetics*
1:00 - 2:15 p.m.	Session 4: <i>Next Steps Roundtable (Where Do We Go from Here?)</i>	Discussion facilitated by Energetics*
2:15 - 2:30 p.m.	Concluding Remarks	⌚ Rich Scheer, Energetics ⌚ Bill Whitehead, Executive Director State Gov't Policy, PJM
2:30 - 3:00 p.m.	Post-Event Media Session	Hilton Alexandria at Mark Center, Media Room

*Note: Each of the four (4) sessions at this symposium will be professionally facilitated and strive to involve every attendee in the development of each topic.



Appendix C: List of Participants

PJM Symposium on Demand Response May 10-11, 2007

ATTENDEE LIST

Full Name (Last, First)	Company/Organization
Alesius, Alan	PJM Interconnection
Angel, Stacy	US EPA
Belbot, Ronald	ISG Sparrows Point
Birge, Calvin	PA Public Utility Commission
Bladen, Jeff	PJM Interconnection
Bleiweis, Bruce	DC Energy LLC
Borlick, Robert	Borlick & Associates
Boucher, Rod	EnergyConnect Inc. (ECI)
Brady, Sean	Illinois Commerce Commission
Buttner, Sarah	Delaware Public Service Commission
Centolella, Paul	Public Utilities Commission of Ohio
Cleverdon, Dan	Public Service Commission of DC
Coleman, Gregory	TRC Energy Services
Conopask, Jeffrey	Southern Maryland Electricity Cooperative
Covino, Susan	PJM Interconnection
Diem, Art	US EPA
Dotter, Ray	PJM Interconnection
Eichenlaub, David	Va. State Corp. Com.
Ellis, David	Enerwise Global Technologies, Inc.

Full Name (Last, First)	Company/Organization
Esposito, Peter	Crested Butte Catalysts, LLC
Ferlmann, Robert	BlueStar Energy Services, Inc
Fernands, Stephen	Customized Energy
Fitch, Neal	Reliant Energy, Inc.
Flaherty, Dale	Duquesne Light
Fried, Alex	Procter & Gamble Paper Products
Fuess, Jay	Premcor Power Marketing
Griffiths, Daniel	Pennsylvania Dept. of Environmental Protection
Haas, Howard	PJM Interconnection
Harrigan, Thomas	DuPont/PJM ICC
Heffner, Grayson	Global Energy Associates
Homa, Rob	PPL
Hood, Douglas	DPL Energy
Hudak, Robert	Sempra Energy Solutions
Hurley, Daniel	Maryland Public Service Commission
Johnson, Brad	ACN Energy Ventures
Kathan, David	FERC
Kerecman, Joe	PJM Interconnection
Kimmel, Elizabeth	EnergyConnect Inc. (ECI)
Kramskaya, Tatyana	FERC
Kujawski, Don	PJM Interconnection
Langbein, Pete	PJM Interconnection
Levin, John	PA Public Utility Commission
Lieberman, Robert	Illinois Commerce Commission
Loxley, Colin	PSE&G
Mabry, David	McNees Wallace & Nurick, LLC
Magnotti, Frank	Comverge, Inc.
Mansueti, Larry	U.S. Department of Energy



Full Name (Last, First)	Company/Organization
Marier, Veronique	Washington Gas Energy Services
Matheson, Eric	Pennsylvania Public Utility Commission
McCartha, Esrick	PJM Interconnection
McCawley, John	PECO Energy /Exelon Corporation
Migden-Ostrander, Janine	Office of the Ohio Consumers' Counsel
Miles, Paul	PECO
Miller, Scott	Constellation NewEnergy, Inc.
Morgan, Richard	Public Service Commission of DC
Ogur, Serhan	PJM Interconnection
Ott, Andrew	PJM Interconnection
Ott, Deborah	FERC
Parikh, Lopa	DC Office of the People's Counsel
Paytash, Stephen	Michigan PSC
Plante, Matt	EnerNOC
Ralph, Elizabeth	Sempra Energy Solutions
Rana, Raj	Appalachian Power
Rasty, Aaron	BlueStar Energy Services, Inc.
Reeping, Bob	Allegheny Power
Regan, Dennis	PJM Interconnection
Reynolds, John	PJM Interconnection
Rieves, Joyce	DPL Energy
Robinson, Evelyn	PJM Interconnection
Robinson, Michael	Midwest ISO
Roush, David	American Electric Power
Saalman, Linda	RG&E/NYSEG
Scheck, Greg	PUCO
Schisler, Ken	EnerNOC
Shirey, James	McKinsey & Company

Full Name (Last, First)	Company/Organization
Stevens, Andrew	DC Energy LLC
Sunderhauf, Stephen	Pepco Holdings, Inc.
Swalwell, Brad	Enerwise Global Technologies, Inc.
Tatum, Ed	Old Dominion Electric Cooperative
Tighe, Mary Beth	FERC
Timmerman, Calvin	Maryland Public Service Commission
Todd, Allen	Downes Associates, Inc.
Urbin, Greg	Constellation NewEnergy, Inc.
Van Dopp, Drew	Downes Associates, Inc.
Walker, Cody	Va. State Corp. Com., Div of Energy Reg.
Waltman, Jeff	Baltimore Gas and Electric
Weishaar, Robert	McNees Wallace & Nurick, LLC
Wellinghoff, Jon	FERC
Whitehead, Bill	PJM Interconnection
Wilhelm, John	PJM Interconnection
Williams, Paul	ISG Sparrows Point, LLC (Mittal Steel USA)
Wood, Lisa	The Brattle Group
Zibelman, Audrey	PJM Interconnection
Zivanovic, Mirija	IBM

Energetics Incorporated Facilitation Team	
Rich Scheer Jan Brinch Brad Spear Lauren Giles	