

Automated Demand Response Program and Energy Efficiency Integration-It's Time to Change

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Abstract: *The Paper describes the Concept and lessons learned from the development and field testing of an Open, interoperable infrastructure to support Automated Demand Response (ADR). ADR gives higher levels of participation. It improves reliability and repeatability of the demand response and customer facilities. ADR systems are organized for critical peak pricing and real time pricing. The system is designed to generate, manage and track demand response signals between utilities, ISO and customers. As peak demand pricing structures become common place, end users stand to benefit from increased controls in their facilities allow them to reduce load when it is most expensive. The paper presents various methods and highlights the importance of integrating EE and DR into one incentive program.*

Keywords: Demand Response, Automation, peak demand

1. Introduction

Although demand response and energy efficiency both are branches of demand side management tree but they don't connect inside a facility. In many cases, different people are responsible for the operations and budgeting associated with each item. However, recent developments will help connect these dots -- and the main connector is automation. Automated demand response (ADR) has the ability to bring the two sides together, through its integration with building energy management systems (BEMS) and its inclusion in new building energy standards and codes.

The concept of integrating the demand side resources like energy efficiency, energy conservation, demand response, advanced metering and Distributed energy resources are termed as integrated demand side management.

a) What is ADR?

Automated Demand response is a demand side management mechanism in which the end users are encouraged to take part in reducing the peak load. The end users in return may be given incentives. This process leads to reduction in the overall system peak load as utility reduces the load of the end-users.

Electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to include lower electricity use at times of high market prices or when system is reliable. Demand response programs are designed to decrease electricity consumption or shift it from on- peak to off peak periods depending on consumer's preferences and lifestyles. Demand response is a reduction in demand designed to reduce peak demand or avoid system emergencies. Demand response involves curtailing power used or by starting on site generation which may or may not be connected in parallel with grid. Demand response allows energy users to act as "virtual power plants" adding stability to the grid by voluntarily lowering their demand for electricity. Demand response

provider's work with commercial, institutional and industrial businesses to identify ways for facilities to participate in demand response programs without effecting business operations, comfort, or product quality.

2. Examples of IDSM Programs

Most of the utilities in US are beginning to learn about IDSM benefits but very few have move forward with integration of various programs together. Southern California Edison for commercial consumers is the first pilot project and NV Energy is second for residential sector.

a) SCE: Upstream HVAC and ADR pilot

Integration of ADR controls with HVAC equipment project has been conducted in southern California Edison (SCE). Incentives are provided to suppliers of equipment like HVAC distributors for end user consumers. For market promotion of energy efficiency and ADR qualifies HVAC controls equipment.

To increase the technology availability of ADR capable with the HVAC distributors and manufacturers it works with efficiency. HVAC system qualifies for high efficiency air conditioners and variable refrigerant flow systems and chillers.

HVAC distributors are provided with specific distributors and contractors with an incentive for the installation of ADR enabled HVAC equipment with preprogrammed DR strategies and configure for receiving DR event signals. By selling energy efficient HVAC equipment to the top layers of incentive participants.

A bonus incentive payment is provide to successfully enrolled customers of SCE for HVAC distributors and contractors HVAC distributors and contractor participants in a qualifying DR program.

Training information and tools are provided on benefits of DR and ADR to market dealers.

For end user customer engagement and DR program enrollment by distributors and market energy agent.

Testing multiple strategies for end user customer engagement and DR program enrollment by distributors and other market actors.

b) NV Energy: Powered

Integration of demand response and energy efficiency for southern Nevada residential customers are deployed which is also an integrated demand side management program under the NV energy utility. The Program includes a free subscription to Eco factor energy optimization service and free installation of least cost intelligent thermostats.

By using computer and smartphone customers can have access to online control to customize HVAC schedules adjusting the temperature settings and can view their energy savings reports on the daily basis which includes both energy and customers benefits.

Consumers are provided with broadband internet and air conditioning systems. The HVAC system based on specific characteristics of consumers home includes outside weather conditions thermal properties and current temperature comfort settings through which energy efficiency savings are generated from optimization service adaptation.

Participants are required to participate in DR events in exchange of energy efficiency savings. After the completion of demand response season EE and DR savings through various survey and savings a high level of satisfaction was found among the customers. By focusing only on HVAC as a residential sector equipment NV energy found success in implementing an IDSM program.

3. Background on IDSM Programs

There are three major factors that drive IDSM program for electrical utilities in US.

a) California's principal energy agencies – the California Energy Commission, the California Public Utilities Commission, and the California Consumer Power and Conservation Financing Authority - adopted the loading order to guide energy decisions. The loading order ensures that energy efficiency (EE), demand response (DR), renewable, and distributed generations (DG) are considered.

To develop and operate California electricity system for long term interest of consumer's ratepayers and taxpayers are intended for loading order. From an environmental and economic point of view. It is much cleaner and cheaper to reduce energy consumption by using energy more efficiently and consciously than to build more power plants. This is the reason why the investors utilities were instructed for implementing and administer the loading order.

b) Second motivating factor for including an integrated EE and DR programs in the Automated Demand Response program is to give benefits to the customer. It was found

that IDSM projects have produced a multiple benefits to the customer instead of implementing one single project which provide one benefits to achieve the various benefits. Customers are able to reduce their demand reduction and realized their energy efficiency at the same time their electricity bills also gets lower.

With IDSM projects the customer receives demand management and also control benefits. By completing both the EE and ADR project at the same time, the customers are able to experience reduced costs and administration complexities normally associated with separate projects.

Another benefit is for capital budget time-horizon in which customers can plan and budget for a large IDSM project in their capital budget instead of having to fit in multiple unplanned smaller project which are harder to fund. The specific type of IDSM project which integrates EE and ADR leverages the rebates available for energy efficiency upgrades. The combination of incentives with available Auto-DR equipment which helps to make expensive controls more cost-effective for customers. The customer are able to realize the benefits of the additional control during a DR event. These many benefits of IDSM projects positively impact the customer which is a large priority for any electrical utility company.

c) The third and final factor behind promoting energy efficiency and automated demand response in one program is to support zero net energy goals. California Energy Efficiency Strategic Plan states that, "50 percent of existing buildings will be retrofit to zero net energy buildings by 2030 through achievement of deep levels of energy efficiency and clean distributed generation" (ZNE Stakeholders 2011, 18)[1]. The ADR program will secure energy efficiency and demand response resources with the energy efficiency savings promotion.

4. Incentive Program by PG & E

The California investor owned utility Pacific Gas & Electric Company (PG&E) deployed a 2012-2014. Automated demand response (ADR) Program that included a separate incentive budget specifically for projects that integrate energy efficiency and automated demand response technologies. The IDSM portion of the PG&E ADR Program was created to support California's loading order for electricity resources and promoting customer benefits of IDSM projects. [2]

The PG&E ADR Incentive Program provides incentives and technical assistance to commercial customers investing in energy management equipment and controls the enable automated demand response[3]. Customers who sign up to participate in an Auto-DR Program receive automated DR event signals from PG&E. These signals are sought out by a technical solution on site that is linking and initiating pre-programmed DR strategies at the customers building. The ADR Program offers incentives and two higher incentive tiers for advanced technology HVAC and lighting to cover the cost of equipment used to automate a buildings ability to respond in a DR event. The ADR Program utilizes a split incentive structure to further

motivate customers to not only install but utilize the installed Controls. The customer receives 60% of the approved incentive value once the equipment is installed, commissioned and verified.[4] The remaining 40% payment is performance based and is paid after the completion of one full DR season and is pro-rated based on the customer's performance over the DR season as compared to their committed kW load shed value [5].

ADR Program also provides technical assistance in addition to monetary incentives. Onsite screening audits and vendor audit are done by ADR technical team to determine customers kW load potential. This includes a technical review of a potential customer's current electricity usage and load curve for calculation of the customer's most recent average summer season baseline. Following installation and commissioning of the Auto-DR equipment, the ADR Technical Team completes a test simulating a DR event to ensure that the building can automatically shed load as compared to the expectations set with the customer by their vendor. It was found to be helpful to the customer to have an outside party assist with verifying that the equipment is installed as expected and operational.



Figure 1: Building Portal system New Tools for Monitoring and Schedule for Consumer Site

5. PG & E ADR IDSM Program Challenges

Implementation of IDSM portion of PG&E ADR Program encountered multiple challenges because at the core it was still focusing on coordinating between two essentially independent PG&E EE and DR incentive programs. ADR program rules and policies were developed independently from the existing EE programs. The design of the IDSM portion was limited to fit within the current ADR and EE program structures instead of having the flexibility to better integrate the EE and ADR in a single program process. The ADR program was rolled out separately from existing EE programs, so that attempts to better integrate the EE effort could not stray very far from the already existing program policies.

Another challenges encountered while reducing consumption through EE reduces the available load for demand response. This increases the importance of coordinating facility audits between ADR and existing EE programs [6]. Challenges included difficulty in accessing

the necessary EE audit information so that adjustments can be made for DR load shed calculations. There were many attempts to integrate DR-specific audit elements which required training of EE-audit engineers[7]. Customer EE program EE vendor, ADR program ADR vendor, utility was the next challenge to balance the goals. To complete an IDSM project an extra effort was to be made for highlighting the misalignment and to remind additional complexities. Finally, the timing of EE and DR program application aligning was conducted for site verification which follows installation of large challenge for the anticipation of IDSM projects.

Application of EE program takes a varying amount of time from start to end whereas deemed rebate application process takes shortest amount of time because the energy savings calculations already been completed on a per unit basis, so the customer only needed to provide documentation supporting for the purchase of unit and the rebate could move forward. In these situations the EE and ADR applications rarely held up the other. For a customized and third party incentive each project have an energy efficiency calculation complete accordingly for specific location and project parameters.

The customized calculations took multiple weeks to complete the review and approval process. Also, since the EE programs were not operated by the same staff as the ADR Program the timing of the audit reviews and verification visits varied greatly depending on the current pipeline of the EE program. Since the customer could not be paid their ADR incentive until the EE project was verified, there were customers that had to wait weeks and sometimes months before receiving their ADR incentive as they were waiting for the EE project to be reviewed and verified.

6. Lessons Learned

Due to the challenges encountered, ADR Program is still out of reach for potential IDSM projects and not yet reserved for all available IDSM incentive program. The IDSM portion of the program was not a complete success but the program team realized three main lessons that can be applied to other utility programs across the country and to other IDSM programs that integrate not just EE and ADR but even EE, ADR and DG or even renewables.

The biggest lesson that was found in many different aspects of implementing the IDSM portion of the ADR Program was that the current IDSM paradigm of taking an EE program and added it to an ADR Program needs to change because at the base it is still two separate programs. The customer still needed to complete two separate applications, to learn and follow two different program processes, to communicate with many different stakeholders to complete the project and to receive two separate incentive checks. Having two different program implementers for the EE and the ADR can create conflict of goals and limit the ability to collaborate towards a common end goal. This additional complexity on top of the technical design of an IDSM project limited some projects from moving forward. The second lesson learned is

that in the current paradigm of adding two or more energy management programs together to create an IDSM program, the customer needs an unbiased champion. A major challenge found in the PG&E ADR Program was that with the many different stakeholders and stakeholder goals it became increasingly difficult for the customer to navigate the entire process on his or her own. The ADR Program was able to play this role of customer champion in many situations because of the program goal of implementing not just ADR but also IDSM projects. The customer champion had a general technical understanding of EE and ADR and could provide technical support to the customer regarding how the two types of measures could create synergies. The customer champion was able to facilitate communication between all the stakeholders when issues arose. During these negotiations, it was useful to have someone that fully understood the goals of each stakeholder to help work with each one to align the various goals. Ideally in the new paradigm where IDSM is a fully integrated type of program the customer champion would be the IDSM program implementer. Finally, the last lesson learned is that the energy industry would benefit from more firms and utilities with experience in implementing IDSM projects. Many companies have focused on one specialty of the energy sector, EE, DR, renewables, but rarely are companies strong technically in multiple resources. Integrated audits have been one way to promote IDSM but in reviewing such audits as a part of this IDSM effort it was apparent the specialty of the company as the other aspects of the audit report was weaker. The ADR Team was able to play the role of customer champion because the team had experience with not only the technical and process side of the ADR Program but also had past experiences with the technical and process side of the many EE Programs. The energy industry now needs to mobilize to design IDSM programs and support these more complex IDSM projects that will likely become the standard.

7. Conclusion

IDSM is proving to be a key factor in reducing energy consumption and helping to keep the environment clean for future generations across various countries. Utility energy management programs combine multiple demand side resources to create greater program efficiencies and provide more comprehensive energy management solutions to the customer. The benefits and concept of IDSM are proved to be easier to understand than to successful implementation of an IDSM project. ADR Program started for better understanding the potential barriers for a program that motivates not only ADR but also EE. One main lesson learned from an IDSM program is to match a separate EE program with an ADR program but instead derive from a specific IDSM program design from the beginning. This is the next step in the evolution of IDSM programs, to create a program that incorporates multiple energy resources and customer can meet all of his or her energy management needs in one program. This is the paradigm shift that energy industry needs to complete to truly unlock the potential of IDSM programs.

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