The Price is Right: The Minimum Incentive Level Commercial Customers Need to Participate in Demand Response

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ABSTRACT

In 2014, Consolidated Edison Company of New York (Con Edison) implemented changes to its two commercial demand response (DR) programs, including shortening the duration of DR events, increasing incentives, and reducing non-performance penalties, with the aim of increasing enrollment and performance. At the time there was limited information to predict the increase in enrollment that could be achieved as a result of the programmatic changes, so the New York Public Service Commission (NY PSC) ordered additional research be conducted alongside the implementation of programmatic changes. In particular, the NY PSC ordered a willingness-to-accept (WTA) study to determine the minimum amount a commercial customer requires to participate in DR. In the fall of 2014, Navigant Consulting (Navigant) conducted a survey of Con Edison customers to determine the minimum incentive required (i.e., WTA) to participate in a commercial DR program. The average WTA values for participants ranged from $7.24 to $15.24 per kW per month, while the average WTA values for non-participants ranged from $9.18 to $18.35 per kW per month—higher than the $6.00 or $10.00 per kW per month that is typical of Con Edison's current DR program offerings. The analysis revealed that performance window and notification period are the primary factors influencing WTA, with commercial customers exhibiting a preference for longer notification periods whereas multi-family customers exhibit a preference for shorter events.

Introduction

The Consolidated Edison Company of New York (Con Edison) categorizes its commercial demand response (DR) programs into two segments: contingency and peak shaving. Con Edison's contingency program, the Distribution Load Relief Program (DLRP), supports the operation of the electric distribution system in New York City and Westchester County when real-time system operational conditions require the reduction of demand within a specific network for a specific period. The peak shaving program, the Commercial System Relief Program (CSRP), focuses on reducing demand on infrastructure in New York City during times of high demand as the result of extreme heat conditions. Table 1 summarizes the two commercial DR programs.

Table 1. 2014 Commercial DR Programs

	Distribution Load Relief Program (DLRP)	**Commercial Systems Relief Program (CSRP)**
Program Design	Contingency program activated by Con Edison in response to system critical situations. Events last for at least four hours with notification provided to participants two hours or less prior to the event. Operates over a summer capability period of May 1 through September 30.	Peak shaving program activated when the day-ahead forecast is 96 percent or greater of the forecasted summer system peak. Events last for four hours with notification provided to participants 21 hours prior to the event. Operates over a summer capability period of May 1 through September 30.
Incentives	Participants who pre-commit load receive a $6 or $15 incentive per kW-month pledged, depending on location, and a performance incentive of $1 per kWh reduced. An additional $5 per kW-month is available for participants agreeing to pre-commit load for a three-year period. Participants who do not pre-commit load only receive a performance incentive of $3 per kWh reduced.	Participants who pre-commit load receive a $10 per kW-month incentive for months with fewer than five events and $15 per kW-month incentive if there are five or more events, and a performance incentive of $1 per kWh reduced. An additional $10 per kW-month is available for participants agreeing to pre-commit load for a three-year period. Participants who do not pre-commit load only receive a performance incentive of $3 per kWh reduced.

For more detailed information, see http://www.coned.com/energyefficiency/demand_response.asp

In an effort to animate the market for DR, Con Edison implemented several programmatic changes in 2014 (Table 2) with the aim of increasing enrollment and performance. Given the limited information available to predict the achievable increase in enrollment as a result of the programmatic changes, the New York Public Service Commission (NY PSC) ordered additional research be conducted alongside the implementation of the changes. In particular, the NY PSC ordered a willingness-to-accept (WTA) study to determine the minimum incentive a commercial customer required to participate in DR.

Table 2. Programmatic Changes Implemented

	2013	**2014**
Incentives	$3.00 or $6.00 per kW-month (DLRP) $5.00 or $10.00 per kW-month (CSRP) $0.50 or $1.50 per kWh reduced	$6.00 or $15.00 per kW-month (DLRP) $10.00 or $15.00 per kW-month (CSRP) $1.00 or $3.00 per kWh reduced
Bonus Incentive	None	$5.00 per kW-month for three years
Event Duration	Five hours or more (DLRP) Five hours (CSRP)	Four hours or more (DLRP) Four hours (CSRP)
Penalty	Twice the capacity payment times the load reduction shortfall (CSRP)	The capacity payment times the load reduction shortfall (CSRP)

Methodology

During the fall of 2014, Navigant Consulting (Navigant) conducted a survey with a sample of Con Edison's commercial and multi-family customers.[1] The primary objective of the survey was to elicit the minimum incentive a customer was willing to accept to participate in a commercial DR program and assess the degree to which program characteristics (such as performance window, notification period, or penalties) or customer characteristics (such as the presence of a DR-enabling technology) influenced incentives.

Survey

The survey was implemented in two stages: (1) a telephone-based screening survey was conducted to identify the appropriate decision maker within the organization, and (2) a web-based survey was delivered to the decision maker.[2] [3] The survey included the following sections:

1. **Firmographics.** Included characteristics of the respondent's organization such as building size, number of employees, hours of operation, and North American Industry Classification System (NAICS) categorization.

2. **Priming.** A challenge with stated preference studies, including a WTA analysis, is that the scenarios presented to the survey respondents are hypothetical. In order to avoid a hypothetical bias, Navigant included a series of priming questions that asked respondents to consider the amount of kilowatts that could potentially be reduced during a DR event at a specific facility (identified by street address) and the measures that could be used to respond to the event (e.g., changing set points on air conditioning systems).[4] The purpose of these questions was to prime the respondent to consider their responses to a hypothetical scenario in the context of their actual facility and potential load reductions. Respondents who indicated they would be unable or unwilling to reduce load during a DR event were not asked the WTA questions.

3. **WTA.** The core set of WTA questions asked respondents to choose the minimum monthly incentive, in dollars per kilowatt per month, needed to participate in a commercial DR program.

   a. The incentive ranges provided were: $3.00, $5.00, $10.00, $15.00, $20.00, $25.00, $30.00, $50.00, and more than $50.00. Navigant also translated the incentive options into the range of potential savings by the end of the summer. Navigant opted to use a payment card approach in which a set of incentive options were provided rather than a discrete choice approach in which only a few incentive options were provided to allow for more variation in the range of incentives. This approach is common in WTA literature.

   Three hypothetical DR programs were presented in which the performance window and notification time varied. The performance window presented was either two hours or four

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[1] Commercial includes both medium (peak demand between 250 kW and 750 kW) and large (peak demand greater than 750 kW) customers.

[2] An incentive of $100 to $150 was offered in exchange for completing the survey. The amount of the incentive was increased during the final weeks of surveying in an effort to increase response rates.

[3] The web mode was selected to allow respondents the ability to read and understand the scenario, question, and potential responses. This approach is consistent with WTA literature that largely relies on mail-based surveys (Champ et al., 2003).

[4] Participants were asked to consider load reductions currently pledged, while non-participants were asked to consider the average or minimum (randomly assigned) kilowatts pledged by participants in their NAICS category. The pledged kilowatt data was obtained through historical data analysis.

hours, while the event notification was either two hours or 21 hours. Table 3 specifies the program characteristics presented in each scenario.

Given that the CSRP program imposes a penalty for non-performance, Navigant included penalty language in the program description for CSRP participants. In addition, non-participants were randomly assigned to have penalty language included in the description.

Table 3. DR Program Scenarios Included in the WTA Survey

	Base Scenario	**Scenario 1**	**Scenario 2**
Participant	Performance window and notification of current program[1]	Performance window changes relative to Base Scenario	Notification changes relative to Base Scenario
Non-Participant	Performance window and notification randomly assigned	Performance window changes relative to Base Scenario	Notification changes relative to Base Scenario

[1] If the customer is participating in both CSRP and DLRP, the performance window and notification period are randomized to be consistent with either CSRP or DLRP.

4. **Technology.** Navigant also included a series of questions regarding the presence of a DR-enabling technology and the influence of technology on the decision to participate in commercial DR programs. If a respondent did not have a DR-enabling technology, the survey gauged the level of interest in various technologies. The technologies addressed in the survey were informed by a technology assessment that identified established and emerging technologies viable in the next three to five years.

The survey targeted both participants and non-participants in the commercial and multi-family customer segments.[5] In total, 189 customers completed the survey.

Willingness-to-Accept Analysis

The WTA analysis used a regression modeling approach to estimate the average incentive a customer anticipates needing to participate in a DR program (i.e., WTA).[6] In addition, this analysis examined how WTA varies with changes in key program characteristics, such as the performance window and notification period. It is important to note that this analysis informed the average incentive a customer anticipates needing to participate in DR, regardless of whether the customer were to enroll directly through Con Edison or through an aggregator.

Navigant estimated a separate model for both commercial and multi-family customers. It was expected that, relative to multi-family, commercial customers could have a different average WTA and may respond differently to changes in program characteristics. Navigant confirmed this by estimating a pooled model, finding that the average WTA was statistically different for multi-family customers.[7] This section presents the model specifications used for both the commercial and multi-family analyses.

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[5] Historically, there have been few multi-family participants in Con Edison's commercial DR programs; as a result, they were not included as a stratum in the sample plan.

[6] As a result of the limited sample size, a meaningful estimate of the price elasticity for DR participation was not estimated.

[7] The pooled model combines the commercial and multi-family customers into a single dataset and includes an indicator variable for multi-family. The multi-family variables were determined to be jointly significant using an F-test (i.e., coefficient estimates for multi-family were statistically different from the coefficient estimates for commercial).

The WTA analysis only included customers that reported being willing and able to participate in a commercial DR program with a reasonable capacity payment ($50.00 per kW per month or less). Customers excluded from the analysis included: (1) respondents who were not asked the WTA questions due to their being unwilling or unable to reduce load during a DR event and (2) respondents who selected the "more than $50" incentive in all scenarios.[8] Thirty-nine percent (or 74 out of 189 who completed the survey) were excluded from the analysis. The majority of these (55 of the 74 respondents) were either unable or unwilling to reduce load during a DR event.[9] All respondents excluded from the analysis were non-participants, with the majority being (76 percent, or 56 out of 74) multi-family customers.[10]

Table 4. Sample of Survey Respondents Included in WTA Analysis

	Commercial	Multi-family	Total
Participant	33	N/A	**33**
Non-Participant	37	45	**82**
Total	**70**	**45**	**115**

Note: Out of the 189 customers who completed the survey, 74 were excluded from the analysis, resulting in a sample of 115 respondents included in the WTA analysis.

After accounting for respondents unwilling or unable to participate in DR, the commercial data set included a total of 70 customers, while the multi-family data set included 45. Three observations corresponded to each respondent (one for each of the three scenarios described in Table 3), reflecting the minimum incentive required to participate in DR under each of the three program scenarios.

The WTA model specification for commercial customers used the following equation:[11]

$$WTA_{i,s} = \alpha_0 + \beta_1 Duration_{i,s} + \beta_2 Notification_{i,s} + \beta_3 Penalty_i + \beta_4 Awareness_i + \beta_5 Technology_i + \beta_6 SqFt_i + \beta_7 CSRP/BOTH_i + \beta_8 DLRP_i + \varepsilon_{i,s}$$

The WTA model specification for multi-family customers was the same as for commercial, except square feet and the indicator variables for CSRP and DLRP as explanatory variables were excluded. Navigant excluded square feet as an explanatory variable as it was not statistically significant and the results did not vary with inclusion or exclusion. Additionally, since no participants in the multi-family sector were sampled, CSRP and DLRP were not included.[12] Table 5 describes the variables included in the model.

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[8] This approach results in a WTA estimate constrained by the maximum capacity payment deemed feasible by Con Edison ($50.00 per kWh per month). Had this constraint not been imposed, the average WTA estimate would have been higher as customers requiring more than $50.00 per kWh per month compensation would have been included in the analysis.

[9] For example, one respondent commented, "Due to our operating schedule, it would be very difficult to participate in such a program." Several noted that they needed more information about the program.

[10] For example, one respondent commented, "The facility about which you have inquired is an affordable rental apartment building. Staff there are maintenance staff. It is not an office or commercial space, so I don't think a demand response program would work for this property."

[11] Navigant tested several alternate model specifications, finding the results were robust to model specification.

[12] Historically, there have been few multi-family participants in Con Edison's commercial DR programs; as a result, they were not included as a stratum in the sample plan.

Table 5. Variable Description

Variable	Description
$WTA_{i,s}$	The minimum incentive selected by respondent i in scenario s. • The survey included a discrete set of incentive options; as a result, Navigant used the midpoint of the lower range for the analysis. For example, if a respondent selected $10.00 as the minimum incentive required, it is possible the true minimum incentive was less than $10.00 but greater than $5.00, the next lowest option offered in the survey. Navigant assigned the midpoint of $7.50 as the minimum incentive to more accurately reflect the average minimum WTA. • In some cases, use of the midpoint yielded incentive amounts that were internally inconsistent with the respondent's incentive selections in the following scenarios. For example, if a respondent selected $10.00 in Scenario 1 and then in Scenario 2 indicated they would be willing to accept a lower incentive of $8.00, using the midpoint of $7.50 for Scenario 1 was inconsistent (i.e., $8.00 is not less than $7.50). For these cases, Navigant did not use the midpoint (i.e., the incentive in Scenario 1 was $10.00 not $7.50). • Navigant used $51.00 as the minimum incentive for respondents who selected "more than $50." While the results were somewhat sensitive when testing different incentive amounts, Navigant chose $51.00 given that respondents tended to overstate their WTA.[13]
$Duration_{i,s}$	Binary variable equal to one if the performance window was four hours and equal to zero if the performance window was two hours. Duration varies with respondent i and scenario s.
$Notification_{i,s}$	Binary variable equal to one if the notification period was two hours and equal to zero if the notification period was 21 hours. Notification period varies with respondent i and scenario s.
$Penalty_i$	Binary variable equal to one if the DR program description included a penalty and equal to zero if penalty language was not included. Penalty varies with respondent i.
$Awareness_i$	Binary variable equal to one if the respondent was aware of DR and equal to zero if unaware.
$Technology_i$	Binary variable equal to one if the respondent had at least one DR-enabling technology, such as a building/energy management system or battery, and indicated the technology had a high level of influence (three or higher out of a six-point scale) over their decision to participate in DR.
$SqFt_i$	Square feet of the facility managed by respondent i (reported in 100,000s).
$CSRP/BOTH_i$	Binary variable equal to one if the respondent was currently enrolled in CSRP only or both CSRP and DLRP and equal to zero otherwise.
$DLRP_i$	Binary variable equal to one if the respondent was currently enrolled in DLRP only and equal to zero otherwise.
$\varepsilon_{i,s}$	The cluster-robust error term for respondent i and scenario s. Cluster-robust errors account for heteroscedasticity and autocorrelation[14] at the respondent level.

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[13] E.g., Moore et al. (2010).
[14] Ordinary Least Square (OLS) regression models assume the data are homoscedastic and not autocorrelated. If either of

Willingness-to-Accept

Table 6 presents the average WTA values, providing insight into whether Con Edison's current incentive levels are sufficient to attract new participants and whether a change in incentives would stimulate customer enrollment. The average WTA values range from $7.24 per kW per month for commercial participants with a two-hour performance window, 21-hour notification period, and a penalty, up to $18.35 per kW per month for multi-family customers with a four-hour performance window, two-hour notification, and penalty. The range of incentives is higher than the $6.00 or $10.00 per kW per month that is typical of Con Edison's current DR program offerings. These results indicate there is a non-linear relationship between the incentive and both the notification and duration.

Table 6. Average WTA by Notification and Duration (with Penalty)[15]

		Duration	
		2 Hours	**4 Hours**
Notification	**21 Hours**	Non-Participant Commercial: $9.18 Participant Commercial: $7.24 Multi-Family: $10.05	Non-Participant Commercial: $12.12 Participant Commercial: $10.17 Multi-Family: $16.08
	2 Hours	Non-Participant Commercial: $14.25 Participant Commercial: $12.31 Multi-Family: $12.31	Non-Participant Commercial: $17.19 Participant Commercial: $15.24 Multi-Family: $18.35

Note: Participants include customers enrolled in CSRP, DLRP, or both. As a result, the WTA values for program scenarios that mimic existing programs cannot be directly interpreted as the WTA for a DLRP or CSRP participant in isolation.

Key findings from the WTA analysis include the following:

- The primary factors influencing the minimum amount for commercial customers are the performance window, notification period, and current participation in a DR program. For multi-family customers, the primary factors influencing the minimum incentive are the performance window and notification period.

- Commercial customers prefer longer notification periods over shorter events, whereas multi-family customers prefer shorter events over longer notification periods.

- Based on the WTA analysis, Navigant found that DR awareness and the presence of a DR-enabling technology did not have a statistically significant influence on the minimum incentive customers require to participate in DR, even when presented with varying performance windows and notification periods.

Commercial

Based on the sample of survey respondents (n=70), the main factors influencing the average minimum incentive a commercial customer anticipates needing to reduce demand is the performance window, notification period, current program participation, and building size (Table 7).

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these assumptions is broken, the resulting standard errors of the parameter estimates are likely underestimated. A random variable is heteroscedastic when the variance is not constant. A random variable is autocorrelated when the error term in this period is correlated with the error term in previous periods.

[15] Based on the average building size of DR-participating commercial customers (771,922 square feet) and non-participating commercial customers in the survey (370,965 square feet).

Holding all other factors constant, the average minimum incentive a commercial customer needs to reduce demand increases by $2.93 per kW per month when the performance window increases from two hours to four hours, while average WTA increases by $5.07 per kW per month when the notification period decreases from 21 hours to two hours. This indicates that commercial customers prefer a longer notification period to a shorter event. [16] This is consistent with businesses that require advanced notice to adjust business plans to accommodate the occurrence of a DR event.

Aside from programmatic changes, current program participation also influences WTA, suggesting that knowledge of existing DR program incentives resulted in responses that anchored near the incentives currently being received by program participants. Using the coefficient estimates to determine the average minimum incentive a DR participant requires to participate in a DR program similar to CSRP (four-hour performance window, 21-hour notification period, and penalty), yields a $10.17 per kW per month incentive. The average WTA for commercial non-participants for a DR program similar to CSRP is $12.12. The $2.00 difference between commercial participants and non-participants is relatively constant across all program characteristics.

Finally, the size of a commercial building is statistically significant, reducing the average incentive needed by $0.29 per kW per month for each 100,000 square feet of building area increase. The negative coefficient estimate indicates that there are economies of scale involved in a commercial customer's response to a DR event. Larger facilities are more likely to have technologies to facilitate a demand reduction, like a building management system, while also typically having a larger number of end uses to leverage in providing a demand reduction. This increased use of technology and larger number of end uses allows for those customers to spread the impact of a demand reduction around their facility and minimize acute impacts to their operations. More efficiently providing a demand reduction and minimizing the impact to business operations allows for larger facilities to accept a smaller capacity payment per kilowatt.

Table 7. Commercial WTA Results

Coefficient		Estimate ($)	t Value	Pr(>|t|)	Significance
Intercept	α_0	10.52	2.51	0.01	***
Duration	β_1	2.93	3.09	0.00	***
Notification	β_2	5.07	4.39	0.00	***
Penalty	β_3	-0.25	-0.06	0.95	
Awareness	β_4	2.46	0.49	0.62	
Technology	β_5	3.74	1.01	0.31	
SqFt[17]	β_6	-0.29	-3.05	0.00	***
CSRP/BOTH	β_7	9.66	1.63	0.10	*
DLRP	β_8	-7.55	-2.48	0.01	***

Significance level of *** one percent, ** five percent, and * 10 percent.

A customer facing a penalty for non-performance, the presence of DR-related technologies, and awareness of DR were all factors included in the model, but none yielded an estimate statistically significant from zero. This does not mean that these factors do not influence the average WTA; rather, it is an indication that the influence of these factors is not consistent enough in the survey data to provide a

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[16] Open-ended comments support this finding. For example, one respondent stated "Once the load shedding is in place the extra hours [i.e., event duration] does not make a difference" while another stated "we would still be able to respond, but the reduced [notification] period would be a greater challenge, but not insurmountable."
[17] Per 100,000 Square Feet.

statistically significant result.

Multi-Family

Based on the sample of survey respondents (n=45), the main factors influencing the average minimum incentive a multi-family customer anticipates needing to reduce demand is the performance window and notification period (Table 8). The average WTA value for multi-family is $8.39 per kW per month greater than the commercial model results, indicating a higher underlying cost of participation in DR for multi-family customers.[18]

Holding all other factors constant, the average minimum incentive a multi-family customer needs to reduce demand increases by $6.04 per kW per month when the performance window increases from two hours to four hours, while average WTA increases by $2.27 per kW per month when the notification period decreases from 21 hours to two hours. This difference in the minimum incentive needed for demand reduction indicates that multi-family customers prefer a shorter notification time over a longer performance period. This is consistent with multi-family customers' comments[19] indicating that their tenants begin to complain when equipment and lighting is turned off. Similarly, survey comments[20] indicated that multi-family customers can respond to an event notification in a relatively short amount of time and are not as sensitive as commercial customers to shorter notifications for demand reduction.

Table 8. Multi-Family WTA Results

Coefficient		Estimate ($)	t Value	Pr(>|t|)	Significance
Intercept	α_0	18.91	4.92	0.00	***
Duration	β_1	6.04	4.34	0.00	***
Notification	β_2	2.27	1.50	0.14	
Awareness	β_4	-4.78	-1.22	0.22	
Technology	β_5	0.54	0.14	0.89	
Penalty	β_3	-8.87	-2.35	0.02	**

Significance level of *** one percent, ** five percent, and * 10 percent.

In addition to the variables included, Navigant conducted additional diagnostic analysis to determine if there were any interactions among other survey variables that would indicate a more complex relationship between average minimum WTA and program characteristics. For both commercial and multi-family customers, Navigant interacted DR awareness and the presence of at least one DR-enabling technology with the performance window, notification period, and penalty. Navigant did not identify any meaningful or statistically significant results using the survey data.[21]

Historical Trends

In addition to the WTA analysis, Navigant analyzed historical program data from 2010 through 2014 to provide an understanding of the impact of programmatic changes on customer enrollment and

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[18] Costs may include both accounting costs (lost revenue, decreased productivity, etc.) as well as other costs such as inconvenience, discomfort, etc.
[19] For example, a multi-family response noted: "I don't believe that we can shut the lights off in the building any longer without push back from the tenants."
[20] For example, a multi-family response noted: "Notification time is irrelevant to me."
[21] The coefficient estimates presented were robust to the inclusion of interaction terms.

pledged load reductions.[22] The analysis provides evidence that the increased incentives, shortened event durations, and reduced penalties implemented by Con Edison were effective at increasing enrollment in 2014. While a review of historical data cannot directly attribute changes in enrollment to programmatic changes, there is evidence of a divergence from historical trends suggesting that the programmatic changes likely contributed to the increase in enrollment. These findings are consistent with the results of the WTA analysis, which found programmatic changes may influence customer enrollment.

The historical data analysis suggests the increase in customer and megawatt enrollment is largely attributed to the following:

- Customer enrollment in CSRP increased by 97 percent in 2014, while customer enrollments in DLRP increased by 12 percent (Figure 1). Large portions of the increase (45 percent for CSRP and 51 percent for DLRP) were customers that were not enrolled in either a Con Edison or New York Independent System Operator (NYISO) DR program in 2013.

- The increase in megawatt enrollment is largely attributed to mandatory DR (42 percent increase in 2014) program enrollments rather than voluntary enrollment options (3 percent increase in 2014).

- The majority of the megawatt increase is attributed to curtailable load (49 percent increase in 2014) rather than onsite generation (9 percent increase in 2014).

- The number of customers enrolled through aggregators increased by 51 percent in 2014, while direct enrollment in Con Edison's programs continues to decline (58 percent decrease in 2014).

Figure 1. Historical Enrollment
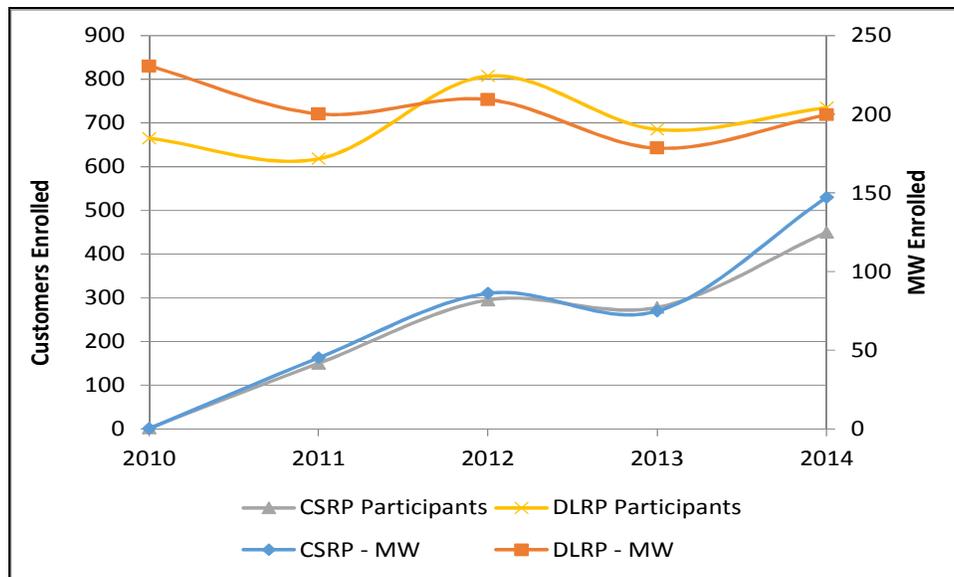
Conclusions

This study has provided several important insights regarding the influence of programmatic changes on enrollment that should inform future DR program planning:

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[22] The dataset includes Con Edison program tracking data identifying the customer, program type (CSRP, DLRP, or both; mandatory vs. voluntary), megawatt enrolled, enrollment channel (direct or through an aggregator), and type of load (curtailable vs. onsite generation). Navigant also used a similar dataset provided for the NYISO DR programs.

- The average WTA values for participants range from $7.24 to $15.24 per kW per month, while the average WTA values for non-participants range from $9.18 to $18.35 per kW per month, which is higher than the $6.00 or $10.00 per kW per month that is typical of Con Edison's current DR program offerings. The average WTA values suggest an increase in incentives may stimulate enrollment.

- The analysis reveals that performance window and notification period are the primary factors that influence the WTA for commercial and multi-family customers. Commercial customers exhibit a preference for longer notification periods over shorter events, whereas multi-family customers exhibit a preference for shorter events over longer notification periods.

- Based on the data available, DR-enabling technology did not appear to influence the responsiveness of the average WTA to changes in the performance window and notification period.

- The historical data analysis provided evidence that the increased incentives, shortened event durations, and reduced penalties implemented by Con Edison have been effective at increasing enrollment in 2014. While the analysis cannot directly attribute changes in enrollment to programmatic changes, there is evidence of a divergence from historical trends suggesting that the programmatic changes likely contributed to the increase in enrollment.

Collectively, these key findings have several implications with respect to program and policy decisions relating to current and future DR programs (Table 9).

Table 9. Implications for DR Program Design

Implications for DR Program Design	Discussion
Shortening the performance window from four hours to two hours may increase enrollment at the current incentive levels.[23]	The WTA analysis reveals that customers are willing to accept a lower incentive for shorter performance windows. This finding applies to all customers in the study, but the relative influence of shortened performance windows is more pronounced among multi-family customers.
The multi-family sector is underrepresented in Con Edison's DR programs as currently designed.	Multi-family customers have historically had minimal participation in Con Edison's DR programs. The WTA analysis reveals that multi-family customers willing and able to participate in DR will be most receptive to a DR program with a two-hour rather than a four-hour performance window and an incentive that is at least $10.00 per kW or higher, depending upon notification time.
Despite the majority of commercial customers having energy management technologies, the WTA analysis did not identify a significant relationship between those technologies and the performance windows or notification times.	While automated technologies, such as a building or energy management system, allow customers to respond to DR events without manual intervention, the average WTA under different performance windows and notification periods remained the same regardless of ownership of a DR-enabling technology. Only battery storage is dependent on the performance window. However, based on survey data, the penetration of battery technology is limited. As a result, currently deployed DR technologies among Con Edison customers are unlikely to have a significant impact on participation decisions as DR program designs evolve.
The programmatic changes implemented by Con Edison in 2014 appear to have resulted in increased participation and indicates a favorable response to increased incentives.	The programmatic changes appear to have resulted in new customers joining Con Edison's DR programs through the facilitation of aggregators. With the vast majority of customers participating in DR programs through an aggregator, it is unclear whether the change in incentives was a driving factor, as the financial agreement between customers and aggregators is not publicly known. The enrollment implications of the WTA analysis results may be diminished if the increase in incentives is not fully passed on to the customers—pending no additional value-added services provided by aggregators.

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[23] Refer to footnote 11.

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