
Memorandum

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FROM: JASON FROST, DOUG HURLEY, PAT KNIGHT, AND JENNIFER KALLAY, SYNAPSE ENERGY ECONOMICS
DATE: SEPTEMBER 24, 2021 - FINAL
RE: 2021 AESC UTILITY SYSTEM BENEFITS FROM DEMAND RESPONSE PROGRAMS

Introduction

The Avoided Energy Supply Cost (AESC) studies provide avoided energy, capacity, capacity DRIPE, energy DRIPE, transmission, distribution, and reliability costs that are used by National Grid (along with other non-energy benefit inputs) to assess the cost effectiveness of its energy efficiency programs. National Grid applies these same values to assess the cost effectiveness of its retail demand response (DR) programs as well. National Grid contracted with Synapse after the 2021 AESC study was released to confirm which of the AESC values should be applied to various types of customers enrolled in its DR programs.

The purpose of this memo is to confirm which AESC avoided costs accrue to the DR programs and determine the extent to which they accrue (e.g., full accrual or partial accrual). The memo addresses capacity, capacity DRIPE, energy DRIPE, pool transmission facility (PTF) transmission, and reliability as these are calculated by Synapse in the 2021 AESC Study. Synapse's determination is based on AESC Appendix K, ISO New England Tariff Section III.12.7 and III.12.8, and ISO New England Operating Procedure 14. Distribution avoided costs may accrue, however, these avoided costs are not addressed in this memo as National Grid calculates these avoided costs separately and they are then integrated into the 2021 AESC Study.

First, we provide an overview of our findings for all avoided cost categories. Next, we provide a more detailed discussion of our findings for each avoided cost category. Within each detailed discussion, we provided detail on different classifications of DR program participants.

Overview

This section provides an overview of our findings regarding the utility system benefits to customers associated with DR program participants who interact with the ISO New England wholesale market in different ways, which we refer to as participation models. Figure 1 illustrates the various participation models. In Table 1, we describe utility system benefits for each participation model in more detail. Throughout this memo we assume that most customers who participate in the ISO New England

Forward Capacity Market (FCM) would choose to do so regardless of the existence of National Grid’s DR programs, based on feedback provided by National Grid.

There are seven participation models we review, including:

1. Not enrolled in ISO markets
2. Front of the meter Generators that produce capacity revenues for third parties
3. Front of the meter Generators that produce capacity revenues for National Grid
4. Energy only front of the meter Generators
5. Behind the meter settlement only generators (SOG)
6. Demand Response Resources (DRR) that produce capacity revenues for third parties
7. DRRs that produce capacity revenues for National Grid (Please note: This example is provided mainly for context as there are no examples of this participation model in existence today.)

Figure 1. Illustration of Participation Models

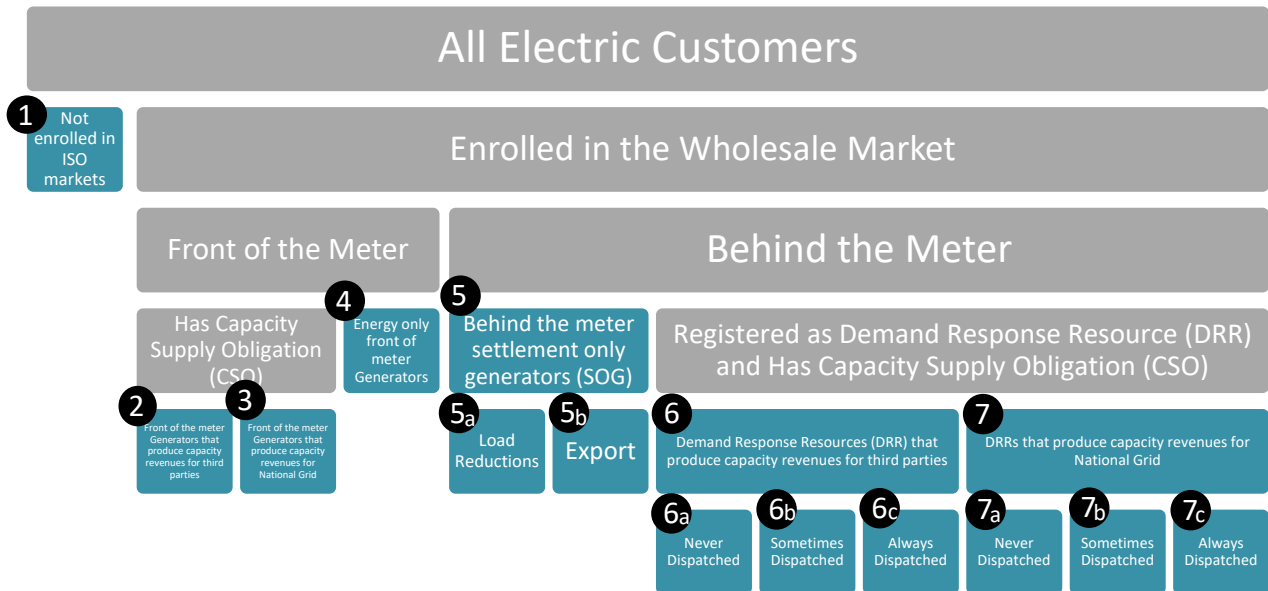


Table 1: Description of Claimable Utility System Benefits to National Grid Customers for Retail Demand Response Programs

Participant Type		Market Participation		Dispatched by ISO during National Grid Event?	AESC Claimable Utility System Benefits to National Grid Customers				
ISO Market Participation Model	Type of ISO Market Resource	Capacity Revenues?	Energy Revenues?		Capacity	Capacity DRIPE	Energy DRIPE	PTF Transmission	Value of Reliability
1	Not enrolled in markets	No	No		Yes, Uncleared (with DR scaling factor)	Yes, Uncleared (with DR scaling factor)	Yes	Yes	Yes, Uncleared (no DR scaling factor)
2	Front of the meter Generator or SOG	Yes (to customer or third party)	Yes		No	No	Yes	No	No
3		Yes (to National Grid)	Yes		Yes, Cleared	Yes, Cleared	Yes	No	Yes, Cleared
4		No	Yes		No	No	Yes	No	No
5	Behind the meter SOG	No	Yes		For load reductions: Yes, Uncleared (with DR scaling factor) For exports: No	For load reductions: Yes, Uncleared (with DR scaling factor) For exports: No	Yes	Yes	Yes, Uncleared (no DR scaling factor)

Participant Type		Market Participation		Dispatched by ISO during National Grid Event?	AESC Claimable Utility System Benefits to National Grid Customers				
ISO Market Participation Model	Type of ISO Market Resource	Capacity Revenues?	Energy Revenues?		Capacity	Capacity DRIPE	Energy DRIPE	PTF Transmission	Value of Reliability
6	Demand Response Resource (DRR)	Yes (to customer or third party)	Yes	Case 1*: Never dispatched	Yes, Uncleared (with DR scaling factor)	Yes, Uncleared (with DR scaling factor)	Yes	Yes	Yes, Uncleared (no DR scaling factor)
				Case 2: Sometimes dispatched	Yes, Uncleared (with reduced DR scaling factor)	Yes, Uncleared (with reduced DR scaling factor)	Yes	Yes	Yes, Uncleared (no DR scaling factor)
				Case 3: Always dispatched	No	No	Yes	Yes	Yes, Uncleared (no DR scaling factor)
7		Yes (to National Grid)	Yes	Case 1*: Never dispatched	Yes, Cleared + Uncleared (with DR scaling factor)	Yes, Cleared + Uncleared (with DR scaling factor)	Yes	Yes	Yes, Cleared
				Case 2: Sometimes dispatched	Yes, Cleared + Uncleared (with reduced DR scaling factor)	Yes, Cleared + Uncleared (with reduced DR scaling factor)	Yes	Yes	Yes, Cleared
				Case 3: Always dispatched	Yes, Cleared	Yes, Cleared	Yes	Yes	Yes, Cleared

*We emphasize that the three dispatch cases we have analyzed for DRRs make it appear, in this context, as if dispatching National Grid’s retail DR programs outside of the hours where they are called upon by the ISO (Case 1) is more beneficial, because they accrue greater Uncleared Capacity and Uncleared Capacity DRIPE benefits. However, we note that other benefits (such as Energy DRIPE and Value of Reliability) likely make coincidence with ISO dispatch more beneficial overall. Most DR resources rarely clear in the ISO energy market, so when they do clear, energy market prices and reliability impacts are likely to be very high. In addition, while not a utility system benefit, energy market revenues earned by clearing during high price hours may increase DR program participation at lower incentive levels.

Avoided Capacity and Capacity DRIPE

There are two ways that participation in National Grid retail demand response programs can provide Avoided Capacity and Capacity DRIPE benefits to all National Grid customers: (1) reducing the amount of capacity purchased in the Forward Capacity Market (FCM) and (2) delivering capacity rights directly to National Grid, so that National Grid can receive capacity revenues to offset its costs.

- The reduction in demand lowers the Installed Capacity Requirement (ICR), which leads to reduced capacity procurement in the FCM. The reduced demand also lowers the capacity price, and the resulting benefits to customers are the AESC Uncleared Capacity and Uncleared Capacity DRIPE benefits. This applies to participation models 1, 5, 6, and 7. All Uncleared Capacity benefits must be adjusted or scaled to account for the frequency with which retail DR resources are called upon by National Grid outside of ISO New England dispatch which we refer to as the DR scaling factor (see AESC Appendix K for more details). During calls outside of dispatch, the ISO views the impact of the participant's action as a reduction in load that impacts later ICR calculations rather than an increase in energy supply. Since load reductions impact the ICR calculation and supply increases do not, only the National Grid calls outside of dispatch contribute to the Uncleared benefits. In the matrix we note the cases in which a DR scaling factor needs to be applied, but do not specify a value. The DR scaling factor should be calculated as described in AESC 2021 Appendix K.
- National Grid can earn revenue from selling capacity into the FCM that offsets its costs to serve customers. The incremental availability of low-cost supply also lowers the capacity price, and the associated benefits are the AESC Cleared Capacity and Cleared Capacity DRIPE benefits. This case applies to participation models 3 and 7. Cleared Capacity benefits are not adjusted by the DR scaling factor.

Participation models 6 and 7 address participants that are often only occasionally dispatched by the ISO, and that are not counted as supply by the ISO in other hours. These unique factors create different cases within these participation models, depending on how frequently National Grid events overlap with ISO dispatch. When National Grid events only sometimes overlap with ISO dispatch, these participation models result in the use of a DR scaling factor that uses a different event frequency than the number of National Grid-called events. In participation model 7, there are also some circumstances in which a single participant can generate both Cleared and Uncleared benefits. This is unique to the structure of how retail DR customers participate in the ISO New England market as DRRs, and results from the potential for ISO dispatch and National Grid calls to occur at different times. Other resource types, such as energy efficiency, can never claim both Cleared and Uncleared capacity benefits simultaneously. We describe each participation model in more detail below.

Participation Model 1 – Not enrolled in markets

Participants not enrolled in ISO markets provide capacity benefits by reducing load on the system. Load reductions impact the ISO's calculation of the region's Installed Capacity Requirement (ICR), which in



turn impacts the amount of generation capacity load purchased in the FCM. As this participation model reduces the ICR, National Grid can claim **Uncleared Capacity and Uncleared Capacity DRIPE benefits**, adjusted for the appropriate DR scaling factor.

Participation Model 2 – Capacity revenues to customer or third party

Generators and SOGs that are bid into the capacity market by customers or third parties are metered and counted as generation by the ISO. Generation from these resources is included in the ISO's calculation of total supply, so these resources do not reduce load. Thus, when the capacity revenues go to the customer or to a third party, these participants provide **no capacity and no capacity DRIPE benefits**¹ to National Grid customers.

Participation Model 3 – Capacity revenues to National Grid

Generators and SOGs that are bid into the capacity market by National Grid provide direct capacity supply payments to National Grid and reduce the capacity price. Therefore, these participants result in a **Cleared Capacity and Cleared Capacity DRIPE benefit** for National Grid customers.

Participation Model 4 – No capacity revenues

Generators and SOGs that are not bid into the capacity market are still metered and counted as generation by the ISO energy market. Generation from these resources is included in the ISO's calculation of total supply, so these resources cannot reduce load. Thus, when these resources generate no capacity revenues, these participants provide **no capacity and no capacity DRIPE benefits** to National Grid customers but would receive energy revenues.

Participation Model 5 – Behind the meter SOG

Resources that are registered as behind the meter SOGs can both reduce on-site loads until demand is zero and can then export generation back to the grid. Exported generation from these resources is included in the ISO's calculation of total supply, so exported generation does not reduce load. However, reduction of on-site loads reduces the ICR and is therefore associated with avoided costs. When these resources generate no capacity revenues, they provide **Uncleared Capacity and Uncleared Capacity DRIPE benefits** adjusted by the DR scaling factor based on the amount they reduce load, but **no capacity or capacity DRIPE benefits** based on the amount of generation they export.

¹ We recognize that to encourage customers to join their programs, third party companies that bid DRRs into the FCM provide the host customer with some form of payment, often tied to expected capacity revenues. This acts as a benefit to participating customers but is excluded here because it is not a system-wide benefit.

Participation Model 6 – Capacity revenues to customer or third party

DRRs are ISO market participants that have on-site loads and that can reduce their consumption of energy and in some cases supply energy back to the grid when dispatched by the ISO. These resources generally offer into the ISO energy market at relatively higher prices compared to other types of resources.

When DRRs are dispatched by the ISO, their load curtailment (and any net supply) is counted as generation and not as a load reduction by the ISO. On the other hand, when DRRs are not dispatched by the ISO but are called by National Grid, their load curtailment (and any net supply) is not counted as generation by the ISO, and therefore is seen by the ISO as a reduction in load. Therefore, these participants can produce **Uncleared Capacity and Uncleared Capacity DRIPE benefits** to National Grid customers by reducing loads and therefore reducing the ICR.

Case 1: Participants never dispatched by ISO during National Grid events

Participants that register with the ISO as DRRs and that are never dispatched by the ISO during National Grid events appear as reduced load and reduce the ICR. These participants provide **Uncleared Capacity and Uncleared Capacity DRIPE benefits** to National Grid customers. We note that most participating customers in National Grid's DR programs today fit within this case.

Case 2: Participants sometimes dispatched by ISO during National Grid events

DRRs that are sometimes dispatched by the ISO during National Grid events only appear as reduced load (and have an impact on ICR) for the fraction of National Grid events during which they are not dispatched by the ISO. As a result, these participants provide the same capacity benefit as participants that are called by National Grid somewhat less frequently but are never dispatched by the ISO during these event calls. These participants provide **Uncleared Capacity and Uncleared Capacity DRIPE benefits associated with a DR scaling factor based on only the number of events the participant is estimated to be called by National Grid and not dispatched by the ISO.**

Case 3: Participants always dispatched by ISO during National Grid events

DRRs that are always dispatched by the ISO during National Grid events appear as generation and do not reduce load or the ICR. These participants provide **no capacity and no capacity DRIPE benefits** to National Grid customers.

Participation Model 7 – Capacity revenues to National Grid

As described under Participation Model 6, participants registered with the ISO as DRRs can produce **Uncleared Capacity and Uncleared Capacity DRIPE benefits** to National Grid customers when they reduce loads outside of ISO dispatch. In addition, DRRs that are bid into the capacity market by National Grid provide direct capacity supply payments to National Grid while pushing capacity prices down and therefore also result in a **Cleared Capacity and Cleared Capacity DRIPE benefit**. The simultaneous generation of Uncleared and Cleared Capacity and Capacity DRIPE benefits is a result of National Grid

calls and ISO dispatch occurring at different times. Creating both benefits at once is therefore unique to retail DR program participants, and is not possible for other resource types, such as energy efficiency.

Case 1: Participants never dispatched by ISO during National Grid events

DRRs that are never dispatched by the ISO during National Grid events appear as reduced load and reduce the ICR. They also generate direct capacity revenues for National Grid in the capacity market and provide low-cost supply into the market. These participants provide **Uncleared Capacity, Uncleared Capacity DRIPE, Cleared Capacity, and Cleared Capacity DRIPE benefits** to National Grid customers.

Case 2: Participants sometimes dispatched by ISO during National Grid events

Participants that register with the ISO as DRRs and that are sometimes dispatched by the ISO during National Grid events only appear as reduced load (and have an impact on ICR) for the fraction of National Grid events during which they are not dispatched by the ISO. As a result, these participants provide the same capacity benefit as participants that are called by National Grid somewhat less frequently but are never dispatched by the ISO during these event calls. They also generate direct capacity revenues for National Grid in the capacity market and reduce capacity prices. These participants provide **Uncleared Capacity and Uncleared Capacity DRIPE benefits associated with a DR scaling factor based on only the number of events the participant is estimated to be called by National Grid and not dispatched by the ISO, as well as Cleared Capacity and Cleared Capacity DRIPE Benefits.**

Case 3: Participants always dispatched by ISO during National Grid events

Participants that register with the ISO as DRRs and that are always dispatched by the ISO during National Grid events appear as generation and do not reduce load or the ICR. These participants still do generate direct capacity revenues for National Grid in the capacity market and reduce capacity prices. These participants provide **Cleared Capacity and Cleared Capacity DRIPE benefits** to National Grid customers.

Energy DRIPE

Energy DRIPE occurs any hour in which a program participant reduces demand or supplies low-cost generation in the ISO energy market. This benefit occurs regardless of how the resource is classified by the ISO and does not depend on capacity market participation status. Thus, all participation models result in energy DRIPE benefits to National Grid customers. If National Grid DR programs result in load increases during hours with lower energy prices, there will be price increases in these hours that partially offset the Energy DRIPE benefits that occur during called events. Energy DRIPE should be calculated as the net benefit of price reductions when load is reduced, minus the impact of price increases when load is increased. Energy DRIPE is not multiplied by the DR scaling factor.

PTF Transmission

Avoided PTF transmission benefits are produced by DR program participants that reduce on-site loads. As a result, front of the meter Generators or SOGs, such as those described above in participation



models 2, 3, and 4, do not produce any transmission benefits. Other types of participants do avoid transmission costs, as shown in participation models 1, 5, 6, and 7.

Value of Reliability

Like Avoided Capacity and Capacity DRIPE, the value of reliability can be either Cleared or Uncleared depending on the capacity market participation of the program participant. Cleared value of reliability occurs because of the FCM clearing a greater quantity of capacity, which decreases the risk of losing load. Uncleared value of reliability, on the other hand, results from an increase in reserves on the system because of the load reduction. For full descriptions of these benefits, please refer to AESC 2021 Chapter 11. Since Uncleared value of reliability benefits come from a reduction in loss of load risk and not from a reduction in the ISO's load forecast, the DR scaling factor is never applied to value of reliability benefits. This also means that a single participant cannot produce Uncleared reliability benefits simultaneously with Cleared reliability benefits by reducing the load forecast.

