



DRAFT

FOR REVIEW AND STAKEHOLDER COMMENT

**Distributed Energy Resources Roadmap
for New York's Wholesale Electricity Markets**

A report from the New York Independent System Operator

August 2016

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1. Executive Summary

Technological advancements and public policies, particularly New York State Public Service Commission's (PSC) Reforming the Energy Vision (REV), are encouraging greater adoption of Distributed Energy Resources (DER) to meet consumer energy needs as well as system needs. DER offer the potential to make load more dynamic and responsive to wholesale market price signals, potentially improving overall system efficiencies.

The NYISO has been directed by the Federal Energy Regulatory Commission (FERC) to make certain market enhancements that allow Demand Response (DR) providers greater opportunities to participate in the real-time energy market and to be properly compensated for any beneficial services they offer the NYISO markets per FERC Orders 719 and 745. This paper, Distributed Energy Resource Roadmap for New York's Wholesale Electricity Markets ("DER Roadmap") will help set the stage for future filings related to those orders. Going forward, the NYISO will consider all DR as Distributed Energy Resources (DER) and facilitate DR participation in competitive markets via the emerging DER program. While FERC has recognized the potential value of DER for bulk power systems and wholesale markets, the PSC has also recognized that rapid advancements in DER and their accompanying controls and communications capabilities will have benefits for distribution system management and end use customers. The PSC initiated the REV proceeding to encourage deeper penetration of DERs, engage end users, promote system efficiency, and meet the challenges presented by New York's aging infrastructure and severe weather events. The proceeding was designed to examine how regulatory policies, utility business models, and market designs could be enhanced to encourage investment in, and operation of, DER technologies.

The PSC's premise is that DER can help to achieve improved system efficiencies if the potential value DER offer is properly reflected in retail and wholesale markets, which are inherently designed to support system needs. Further, the PSC believes that DER will proliferate if utilities have proper incentives to consider DER as alternatives to traditional capital investments in infrastructure reinforcement and expansion. The PSC envisions these resources serving local needs through Distribution System Platform Providers that plan, operate, and administer markets for distribution-level services.

The vision articulated by the PSC is, in many ways, consistent with the manner in which the NYISO administers wholesale markets, plans for bulk system needs, and operates the grid. Competitive wholesale markets were designed with the intent of facilitating demand-side elasticity where end users could participate in the market by adjusting their energy usage in response to price signals reflecting system needs or conditions. For a variety of reasons, ranging from the economics and limitations of enabling technologies, this demand elasticity has failed to materialize to a significant degree. As mentioned above, the economics and technological capabilities are improving. With some modifications, the NYISO expects to be able to integrate DER into its wholesale markets to build upon the efficiencies already realized under competitive wholesale market structures.

Through the DER program, the NYISO will accommodate controllable resources with various capabilities and a desire to participate in the wholesale markets. Integrating DER in this manner will require

enhancements to wholesale market design, system planning, and grid operations to better align resource investments and performance with system needs and conditions.

The NYISO generally considers DER to be behind-the-meter resources, although small aggregations of remote net metered resources, such as community solar, will also be considered DER. Some DER may be net generators and others net loads. For resources that are net generators, the scope of participation in these programs would be limited to resources and aggregations that do not meet the requirements of NYISO's existing Behind-the-Meter Net Generation program.

Currently, DER can support NYISO markets, planning, and operations in a limited manner – primarily through the NYISO's reliability-based DR programs where DER can be called upon to reduce demand to maintain system reliability. Enhanced integration of DER into New York's wholesale electricity markets will more efficiently support operations and planning. This integration will also provide dynamic price signals to inform DER investment and operational decisions.

This paper discusses the NYISO's proposed approach for enhancing the integration of DER into New York's wholesale electricity markets through a DER roadmap designed to increase DER participation in economic-based DR programs. The discussion presents proposals to enable the participation of many types of behind-the-meter resources in the NYISO markets and provides a framework for developing specific market designs and rules over the next three to five years.

With the guidance of this roadmap, the NYISO envisions integration of DER into its markets through the economic dispatch of such resources in a manner that aligns compensation with system requirements. Realizing this goal will require an examination of DER performance obligations, operating characteristics, metering and telemetry requirements, measurement and verification of baselines and performance, market modeling, and an understanding of how to balance the simultaneous participation of DER in retail/distribution-level programs as well as the NYISO's competitive wholesale market.

The NYISO recognizes that comprehensive planning will be crucial to facilitate the smooth transition to an economic-based approach that relies on participation in the NYISO's wholesale Energy and Ancillary Services markets supporting reliability and market efficiency. For instance, the NYISO's existing Special Case Resources (SCR) program has proven to be a valuable tool for planners to project load forecasts and for operators to manage system reliability. As such NYISO plans to retain the SCR program, with potential modifications designed to complement this DER roadmap, to maintain certainty for Market Participants, stability in the New York wholesale markets and ensure operators have effective tools to preserve reliability during periods of peak demand or system stress.

Overview of the DER Roadmap

The NYISO's efforts to integrate DER into wholesale electricity markets seek to achieve five key objectives.

- Integration of DER into Energy and Ancillary Services Markets: Currently, there are limited options for DER to participate in NYISO's Energy and Ancillary Services markets. The DER program will provide avenues for DER to take advantage of economic scheduling and real-time locational prices.
- Align with the goals of NYS REV: NYISO's goal is to provide open access for DER to participate in the wholesale markets. This aligns with NYS REV objectives of market animation and leveraging customer contributions, increasing system wide efficiency, and improving system reliability and

resiliency. NYISO’s approach to DER participation is to focus on bulk system needs and performance requirements of resources and to provide opportunities for facilitating demand-side elasticity.

- **Enhanced Measurement and Verification:** Accurate load forecasts are essential to balancing supply and demand in real-time. In order to ensure that NYISO is able to accommodate various technologies and customer load profiles, enhancing the measurement and verification methodologies is critical. . The data provided by these enhancements will help system planners and grid operators better prepare for system needs and support the continued reliability of the bulk power system while further improving system efficiency.
- **Align Compensation with System Requirements:** Markets function best when payments are aligned with the value of services provided. In this context, the NYISO intends for the DER program to align incentives and compensation based on the flexibility and measured performance of the DER (or aggregation), and market clearing prices based on the needs of the system. The intent is to treat DER comparably with other supply resources participating in the NYISO’s Energy, Capacity and Ancillary Services markets.
- **Focus on Wholesale Market Transactions:** Unlike traditional wholesale generators that are primarily connected to the high-voltage transmission grid, many of DER will be connected to the distribution networks. To ensure bulk power system reliability, it is important to accurately represent DER impacts at their corresponding interface to the bulk power system, which is typically at the transmission-level substation load bus associated with that distribution network.

The NYISO’s roadmap envisions that DER will be treated in much the same manner as traditional generators, while recognizing each set of resources’ different capabilities. For instance, the NYISO anticipates that DER participating in the Capacity market will have capacity obligations that require offering into the Energy and Ancillary Services market for all or a portion of the day, depending on the business model and capabilities of the DER. Capacity and associated payments would reflect the operational value of the DER’s contribution to the system and be prorated on the basis of the amount of time it is providing service. The traditional generation resources with capacity obligations that are not selected in the Day-Ahead Market must be available in the Real-Time Market for potential reliability commitments from grid operators, the NYISO anticipates that DER with capacity obligations will be obligated in a similar fashion. Those DER not electing to participate in the Capacity market may still choose to offer into the Energy and Ancillary Services markets provided they have the necessary capability.

The NYISO recognizes that, unlike traditional generators, DER will likely participate in its markets on an aggregated basis. The NYISO’s current infrastructure for meter data supports Point Identifier¹ (PTID) level data of large supply resources, primarily collected through telemetry for real-time operations and monitoring functions, and after-the-fact uploads to support settlement. The integration of DER into Energy and Ancillary Service markets is expected to follow the same model. DER will be required to provide PTID-level real-time supervisory control and data acquisition (SCADA) quality or better telemetry data for operations and monitoring functions, and after-the-fact revenue quality meter data from individual resources for measurement and verification, and settlements. Some of these measurement and

¹ Point Identifier is a numerical identifier used in NYISO’s systems and models to identify resources

verification services may be performed by the DSP. As part of this roadmap the NYISO intends to explore the use of real time telemetered data from a sample set of resources participating as a DER aggregation.

The NYISO envisions the future state of DR programs to look like that of the Figure 1 below. Some of the existing programs would remain intact while others would be replaced. As shown below, the current SCR program, Emergency Demand Response Program (EDRP) and Price Capped Load Bidding would remain. The current Day-Ahead Demand Response Program (DADRP) and Demand Side Ancillary Services Program (DSASP) programs would be replaced with the DER program.



Figure 1. Wholesale Market and Programs Mapping

Implementing the DER initiative will entail considerable time, effort, and stakeholder engagement. This roadmap represents a starting point for initiating discussions that will lead to further refinement on key market design elements, functional requirements, and tariff language necessary to implement the vision.

2. Introduction

The scope of DER has been growing in New York’s electric system for several years. No longer limited to infrequently-run emergency generators, many types of behind-the-meter technologies have expanded to applications that address local needs for power quality, energy cost savings, carbon footprint reductions, and increased resiliency. Advances in technology are creating new products that are changing the model of how energy is produced, stored, and consumed. New “smart” devices are equipped with two-way communications capabilities as well as the ability to “learn.” Accompanying these enhanced intelligence capabilities are increases in storage efficiency and the emergence of technologies that are improving the economics of storage. Ultimately, storage will help make DER a more effective and complete solution for grid operators and system planners. Combined, these advances will allow consumers to change their consumption profiles in an effort to lower costs, access new sources of revenue, and/or reduce the environmental impacts of their energy use.

Integrating DER in Wholesale Electricity Markets



Figure 2. Wholesale and Retail Market Relationships and Coordination

Figure 2 above illustrates the conceptual framework for coordination between retail and wholesale electricity markets for the integration of distributed resources.

At the national level, the FERC is addressing DER-related issues, including Order 719 and Order 745, which direct the NYISO to implement changes to its DR programs and build a full set of DR products which will allow DR resources to participate in wholesale Capacity market as well day-ahead and real-time wholesale Energy and Ancillary Services markets. The NYISO’s DER roadmap is designed to outline the manner in which the DR programs will evolve to meet its directives from the FERC as well as to be complementary and coordinated with retail initiatives.

Recognizing the rapid advancements in DER and their accompanying controls and communications capabilities, the PSC initiated REV proceeding to encourage deeper penetration of DER, engage end users, promote system efficiency, and meet the challenges presented by New York’s aging infrastructure

and severe weather events. The proceeding is designed to examine how regulatory policies, utility business models, and market designs could be enhanced to encourage investment in, and operation of DER technologies. REV envisions these resources serving local needs through Distribution System Platform Providers that plan, operate, and administer markets for distribution-level services. At the same time, many believe that these resources can potentially contribute to bulk power system needs through participation in wholesale markets.

The vision articulated by the REV framework is, in many ways, consistent with the manner in which the NYISO administers wholesale markets, plans for bulk electric system needs, and operates the grid. Wholesale electricity markets were designed with the intent of facilitating demand-side elasticity where end users could participate in the market by adjusting their energy usage in response to price signals reflecting system needs or conditions. For a variety of reasons, including the economics and limitations of enabling technologies, this demand elasticity has failed to materialize to a significant degree. However, the economics and technological capabilities are improving. With some modifications, the NYISO expects to be able to integrate DER into its wholesale markets to build upon the efficiencies already realized under competitive wholesale market structures.

The precise technological mix and scale of DER penetration is unknown and will be greatly influenced by the economics of the technologies themselves as well as evolving rules and incentives established by public policy. However, the likely mix of resources will include a combination of technologies that are intermittent and passive as well as others that are predictable and controllable. Those intermittent and passive resources that emerge will unlikely be able to actively participate in the NYISO's wholesale markets. Rather, they will be integrated into wholesale markets indirectly, in the form of modifications to load forecasts through enhanced forecasting tools that will influence the dispatch of supply resources on the bulk power system. To the extent that NYISO Market Participants install DER that are predictable and controllable, such resources may be more actively integrated into wholesale electricity markets and market-based compensation at the wholesale level should play a role in supporting the economics of those resources.

The potential of these DER to improve demand elasticity presents opportunities to further enhance the efficiency of wholesale electricity markets. However, there are uncertainties about the capabilities that the technologies may offer the bulk system while also serving distribution system or end-user needs, the level of investment likely to be realized, and the limited visibility into these investments and technologies.

To provide a foundational background of the potential for DER in New York State, the NYISO commissioned a study² in 2013 to comprehensively review DER technologies. The study examined DER market potential and investment drivers, assessed regulatory treatment and policies influencing their potential, and reviewed treatment of DER in other balancing authorities and utility regions. For purposes of its study, the NYISO considered DER to include behind-the-meter power generation and storage technologies located on an end user's premises and operated for the purpose of supplying all or a portion of the customer's electric load, but with the potential to inject power into the transmission system, distribution system, and/or a parallel local non-utility grid. DR was not examined specifically by the study as the goal of the study was geared toward assessing various technologies themselves, viewing DER as

² NYISO: *A Review of Distributed Energy Resources*, Prepared by DNV GL, September 2014, http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Other_Reports/Other_Reports/A_Review_of_Distributed_Energy_Resources_September_2014.pdf

enabling technologies to facilitate DR activity. The study concluded that DER adoption is well underway throughout the United States due to public policies encouraging DER as well as performance improvements and cost reductions among the technologies themselves. Further, the study found remaining technical potential for DER expansion to be significant and poised for growth.

This roadmap outline the steps involved to integrate DER into NYISO markets and operations. Ultimately, the NYISO will need to develop the requirements, performance obligations, and compensation that will enable DER to be recognized in NYISO’s markets based upon the value of the services that they provide. New business models for DER participation in NYISO markets may be necessary to optimize alignment between DER investments and operations and the NYISO’s price signals and system needs. The phase-in of more granular price transparency will be important for guiding DER investment and operational decisions in response to price signals that reflect location specific system needs. Ultimately, meter data policy and market price delivery schemes will need to be developed, refined, and implemented to ensure that the value that wholesale electricity markets have produced for consumers is enhanced with the additional integration of DER.

3. Current State of DER Integration

As the NYISO’s markets are currently designed, DER provide important, but fairly limited support to bulk power system needs. DER are primarily utilized in support of NYISO Demand Response programs – both reliability-based and economic-based products. To date, the NYISO’s economic-based demand response products have elicited only limited participation.

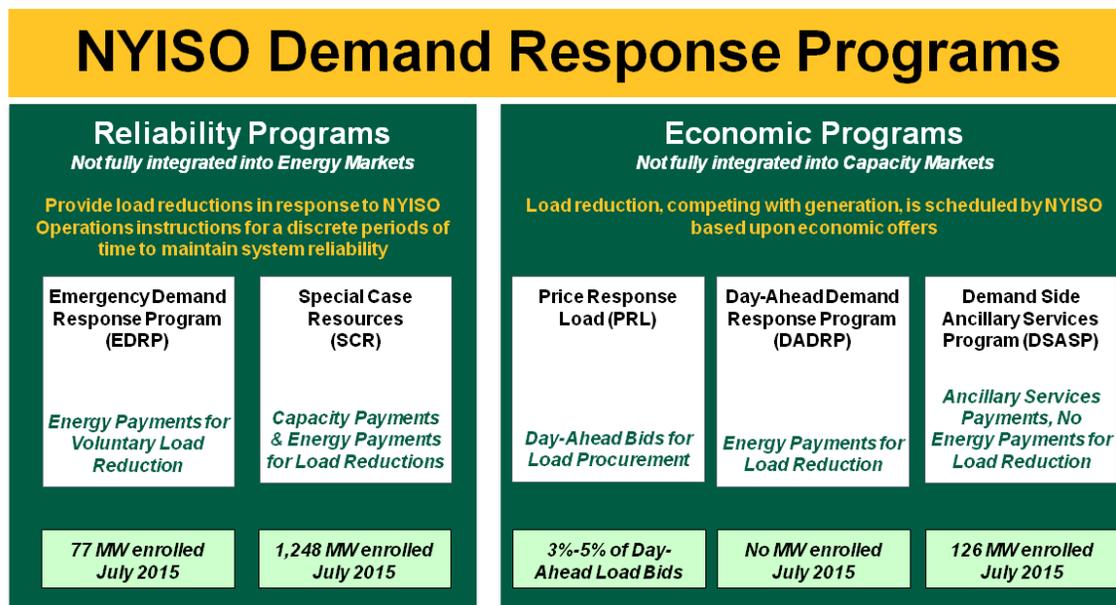


Figure 3. NYISO Demand Response Programs

Figure 3, above, illustrates NYISO DR programs, which includes three primary economic-based DR products. The DADRP offers end users the potential to participate in the market by identifying load reductions in response to Day Ahead price signals. Under this program, end users identify a price point

at which they are willing to curtail load, either by simply reducing their electricity use or by self-supplying a portion of their load with DER. Based on their ability to deliver the scheduled load reduction, these end users receive energy payments. While a potentially effective tool to elicit demand elasticity, as of July 2015 the program had no participation.

The NYISO's second economic-based demand response initiative is its DSASP. In this program, end users capable of delivering load response can potentially receive payments for supplying ancillary services such as Operating Reserves or Regulation Service provided they are capable of modulating their demand in response to basepoint signals from the NYISO. As of July 2015, the DSASP had 126 MW of capacity registered and participating in the market, providing approximately 19% of the 10-minute spinning reserves.

A third economic-based mechanism for DER to participate in the NYISO markets is the Day-Ahead Price-Capped Load bidding, in which a Load Serving Entity (LSE) chooses to submit price-sensitive day-ahead load bids for the amount of load it procures. Price responsive load modeling in the NYISO's two-settlement energy market provides a relatively simple way for DER to participate in wholesale markets. Essentially, DER are used by the LSEs as a tool to modulate load in response to wholesale price signals. LSEs submit load bid curves to the NYISO reflecting a "willingness to buy" energy by modifying load purchases in response to the NYISO's clearing price, relying more heavily on wholesale energy purchases during periods of low prices while activating DER to displace wholesale energy purchases during periods of higher market prices. Approximately 3-5% of submitted day-ahead Load bids are price responsive. However, this program is limited to LSEs and is only offered in the Day-Ahead Market.

There is comparatively more active participation from demand response in the NYISO's reliability-based initiatives. The EDRP is supported by roughly 77 MW of resources. In this program, end users capable of curtailing load enroll and perform on a voluntary basis only. Essentially, when the NYISO declares a need for demand reduction based on projected system conditions, it requests EDRP participants to activate their curtailment strategies. Subsequently, based on verification of performance, the NYISO provides an energy payment to those participants. While useful in supporting near-term reliability, the voluntary nature of the program makes it less ideal for long-term planning and grid management.

A more reliable tool for planning and grid management is the SCR program. In this program, end users can access capacity payments by enrolling in the program and being available when the NYISO needs to activate them. Once called upon to curtail load, provided a 21-hour (24 hours if after 3 pm) advisory notice is given and a 2-hour activation notice is given, participants have an obligation to respond and are subject to penalties if they do not meet their performance obligation. In addition to Capacity payments, these participants also receive energy payments for real-time performance. This program had 1,248 MW of participation as of July 2015 and has been activated on numerous occasions when load levels were anticipated to cause violations of reserve levels that could ultimately create reliability problems on the grid.

As the primary interface with DER, the SCR program has proven a valuable tool for grid operators to avoid reliability disruptions. At the same time, planners have relied upon SCR enrollments in forecasting to determine if the system is capable of handling projected peak loads while maintaining compliance with reserve requirements.

However, as a market product the SCR program may be considered inflexible. While market participants can choose whether to enroll in the program, and are rewarded for enrollment in the form of capacity payments, they have little ability to predict or control what effect their enrollment will have on their own operations. In 2013, the SCR program was called upon five times, including on five consecutive days in several NYISO load zones. In some cases, the repeated calls for SCR activation prompted concerns from market participants due to the effect that reducing their load had on their core businesses and operations. In contract, the SCR was not activated at all during Summer 2014 of Summer 2015.

From the NYISO's perspective, the SCR program is a generally effective way to reduce strain on the grid during periods of high demand. However, the initiative does have shortcomings. First and foremost, the SCR program must be manually activated. There are no pre-defined price signals that can be used to call upon resources. Operators must look at load forecasts as well as generator and transmission availability to determine whether SCR resources will be necessary to maintain reliability. Since NYISO Operations must activate the SCR program based on the forecasted conditions, these actions are inherently less efficient from a market perspective. Further, there is limited ability to target SCR calls in response to localized conditions on the grid. Typically, SCR resources are activated on a statewide or, less frequently, on a zonal basis. From a grid operations perspective, the SCR program is generally effective in supporting grid reliability, but does so in a relatively inflexible and inefficient manner.

I. Purpose and Scope of this document

Technological advancements and public policies, particularly NYS REV, are encouraging greater adoption of DER to meet consumer energy needs as well as electric system needs. DER offer the potential to make load more dynamic and responsive to wholesale market price signals, potentially improving overall system efficiencies.

The NYISO has been directed by the FERC to make certain market enhancements that allow DR providers greater opportunities to participate in the real-time energy market and to be properly compensated for any beneficial services they offer the NYISO markets per FERC Orders 719 and 745. This document will help set the stage for future filings related to those orders. Going forward, the NYISO will consider all DR as DER and facilitate DR participation in competitive markets via the emerging DER program.

Through the DER program, the NYISO will accommodate controllable resources with various capabilities and a desire to participate in the wholesale markets. Integrating DER in this manner will require enhancements to wholesale market design, system planning, and grid operations to better align resource investments and performance with system needs and conditions.

The NYISO generally considers DER to be behind-the-meter resources, although small aggregations of remote net metered resources, such as community solar, will also be considered DER. Some DER may be net generators and others net loads. For resources that are net generators, the scope of participation in these programs would be limited to resources and aggregations that do not meet the requirements of the NYISO's existing Behind-the-Meter Net Generation program.

The purpose of this document is to outline, for stakeholder consideration and feedback, the NYISO's vision for integrating DER into Energy, Capacity, and Ancillary Services markets. It outlines high-level concepts for facilitating the emergence of a DER program that seeks to optimize DER integration into a

series of economic-based DR products. Doing so will promote greater grid and market efficiencies by coordinating load in conjunction with supply on the basis of price signals. Reliability-based DR, such as the SCR Program, will likely continue to be an important, if perhaps transitional, tool for system operators to curtail load in response to periods of high demand or emergency system conditions that could threaten reliability. However, by facilitating the growth of economic-based DR products, the NYISO is looking to more effectively manage demand through automated economic transactions that reduce the need for manually activated reliability-based DR.

1. Key objectives behind this effort

While the types, configurations, and capabilities of DER vary depending on the needs of the customers installing them, it is certain key objectives will guide the effort to integrate them into the NYISO's wholesale electricity markets. These objectives include:

1.1. Integration of DER into Energy and Ancillary Services Markets

The NYISO seeks the seamless integration of DER into Energy and Ancillary Services markets. Currently, there are limited options for DER to participate in NYISO's economic programs. The DER program will provide avenues for DER to take advantage of real-time scheduling. It is important for the NYISO's real-time systems to be able to access and dispatch these resources in response to price signals reflective of grid conditions and needs. From an operational perspective, the intent of this effort is to minimize out-of-market manual activation of these resources by operators. Ultimately, the vision is to enhance the NYISO's portfolio of DER products by creating a market environment that facilitates the emergence of DER capable of being dispatched by grid operators in the context of market offers and prices. At the same time, the NYISO's vision offers end users added flexibility to meet their energy needs more economically by modulating their demand for grid-based electricity in response to price signals.

1.2. Align with the goals of NYS REV

NYISO's goal is to provide open access for DER to participate in the wholesale markets. This aligns with NYS REV objectives of market animation and leveraging customer contributions, increasing system wide efficiency, and improving system reliability and resiliency. NYISO's approach to DER participation is to focus on system needs and performance requirements of resources and to provide opportunities for facilitating demand-side elasticity.

1.3. Enhanced Measurement and Verification

Accurate load forecasts are essential to balancing supply and demand in real-time. In order to ensure that NYISO is able to accommodate various technologies and customer load profiles, enhancing the measurement and verification methodologies is critical. The data provided by enhanced measurement and verification will help system planners and grid operators better prepare for system needs and support the continued reliability of the bulk power system while further improving system efficiency.

1.4. Aligning Compensation with System Requirements

Market function best when payments are aligned with the value of services provided. In this context, the NYISO intends for the DER program to align incentives and compensation based on

the flexibility and measured performance of the DER (or aggregation), and market clearing prices based on the needs of the system. The intent is to treat DER comparably with other supply resources participating in the NYISO's Energy, Capacity and Ancillary Services markets.

1.5. Focus on Wholesale Market Transactions

Unlike traditional wholesale generators which are primarily connected to the high-voltage transmission grid, many of the DER will be connected to the distribution networks. To ensure bulk power system reliability, it is important to accurately represent DER impacts at their corresponding interface to the bulk power system, which is typically at the transmission-level substation load bus associated with that distribution network.

Achieving these key objectives will facilitate the integration of DER either directly into the NYISO markets or indirectly by understanding the implications of such resources for load requirements as the NYISO plans and operates the bulk power system. The NYISO envisions that those resources capable of participating in its markets will do so directly or via third-party aggregation (including potentially via the Distribution System Platform Providers envisioned in the New York State PSC's REV recommendations) such that these smaller resources can be aggregated together in a coordinated fashion to respond to price signals in support of bulk system needs. For those resources incapable of participating in wholesale markets, the NYISO will require new forecasting and planning tools to understand the impacts of such resources in order to continue dispatching the bulk system in an economically efficient manner. Such tools might include solar forecasting, enhanced communications and advanced metering to facilitate increased data exchange and collection with aggregators and Utility/Distribution System Platform Providers, and enhanced coordination with utilities to take into account the long-range implications of DER investments for resource adequacy and transmission security analyses.

Integrating DER in Wholesale Electricity Markets



II. Future Direction: DER program to Facilitate Economic-Based Resources

The NYISO sees the DER program as expanding opportunities for DER by opening up wholesale electricity markets for combinations of technologies that may not currently participate. Specifically, the DER program would enable five types of resources to participate in the NYISO's Energy, Capacity, and Ancillary Services markets. These resources include (See Appendix A for use cases):

- Load-only resources – those end users that may be able to modulate their energy usage strictly through load curtailment measures
- Load with Generation – those end users capable of dispatching behind-the-meter generation resources and/or load curtailment to reduce their demand from the grid
- Load with Storage – those end users capable of calling on behind-the-meter storage resources and/or load curtailment to modulate their demand for energy from the grid
- Load with Generation and Storage – those end users who can call upon a combination of behind-the-meter generation, storage and/or load curtailment to adjust their demand
- Controllable generation with remote retail load obligations



Figure 1. Wholesale Market and Programs Mapping

The SCR program will continue while providing flexibility in resource duration and payments that are consistent with the resource/aggregation’s performance. The EDRP will also continue as a voluntary reliability program with resources receiving energy payment for confirmed load reductions based on NYISO requests on peak days. DER will still be able to operate as load modifier at the distribution level, ultimately reducing the LSE’s capacity obligation. LSEs will also be able to continue to use DER to modify their load on the bulk system to meet the schedules that they receive in the Day Ahead Market through the price responsive load bidding. Additionally, DER would be enabled to respond to day-ahead and real-time wholesale market price signals. The offers will express participants’ economic willingness to reduce their demand for energy from the grid or increase their supply of energy to the grid, enhancing the value of the resources. By automating distributed resources via economic signals, the NYISO can more efficiently manage the system while offering participants more predictability and stability in weighing the value of reducing load against any costs incurred for doing so.

The NYISO intends to facilitate the growth of dispatchable DER based on price signals. The NYISO anticipates retaining the current SCR and EDRP programs but will adjust resource compensation to be commensurate with NYISO’s operational needs. The goal is to take advantage of the improving economics of DER and advances in energy management and information technologies to facilitate the integration of DER into NYISO’s economic-based markets. Effectively, DER program will treat distributed resources comparably with gas turbine generators, fully integrating them with Energy and Ancillary Services markets, while awarding capacity payments reflective of the performance capabilities of the resources. Creating a viable mechanism for DER to participate in markets on an economic basis offers advantages to NYISO markets as well as participants.

Price-responsive load will improve economic efficiency because it will reduce the need to call high-cost peaking generation. At the same time, DER operating in response to economic signals can work to shift grid-based electricity consumption to off-peak hours, creating the potential for greater stability in prices throughout the day by flattening the load. In this sense, the NYISO’s vision for the DER program aligns well with the vision for REV in that it offers the potential to engage or animate certain consumers in ways that support more optimized grid utilization while helping these consumers better manage their own

energy needs and costs. The potential for improved grid utilization of the existing infrastructure may help to avoid expensive capital investments that might otherwise be needed to meet peak demands over relatively few hours during the year.

III. Performance obligations

DER with Capacity Obligation

Traditional generators participating in the NYISO Capacity market are required to submit an offer in the Day-Ahead Market for at least the amount of capacity they sold in the Capacity market. Similarly, DER will be required to submit an offer in the Day-Ahead Market for at least the amount of capacity they sell in the Capacity market. DER desiring full capacity and associated capacity payment may also be expected to be capable of delivering demand reduction or incremental supply for a full 24 hour period, comparable to what is expected of traditional generators.

However, the NYISO recognizes that some DER will be unable to offer in all 24 hours due to their physical characteristics. (For example, DER aggregations consisting of load curtailment assets that have a typical “9 to 5” load profile.) DER that are able to offer in for less than 24 hours are still valuable to the system, but provide less operational value as compared to a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service durations that DER can provide to help the NYISO meet its daily load. These may include full day service, daytime service and peak time service.

A full day service DER is a resource that is able to provide wholesale service for all 24 hours in a day. A daytime service DER helps the NYISO meet its load during early morning through late evening hours. A peak time service DER helps the NYISO manage its daily peak hours. It is reasonable to conclude that full day serving DER has a higher value than daytime serving DER which is more valuable than peak time serving DER. Consistent with the key principle of aligning payments with system requirements, the NYISO believes that compensation commensurate with a DER’s capabilities and performance is appropriate. Such resources are thus expected to receive pro-rated capacity and associated capacity payments. With inputs from stakeholders, the NYISO expects to use an administratively determined methodology to determine capacity that reflects the comparative value of DER that are able to provide service all day versus those that cannot.

As part of this effort, the NYISO also plans to look at establishing an offer window for DER providing fewer than 24 hours of service. This window is expected to be consistent with the load service that DER is intended to perform for the NYISO to balance supply and demand.

Day-Ahead offers submitted by DER that primarily uses load curtailment assets will most likely reflect the high lost opportunity cost of foregoing electricity consumption. As a result, the Day-Ahead Market offers by resources using curtailment will likely include these high costs and there is a good probability that these resources will not get scheduled in the NYISO’s Day-Ahead Market. This is because most of the time Day-Ahead Market prices are just not high enough. Apart from the 10-minute capable resources located East of Central East who have an to offer into the Real-Time market, there is currently no requirement for traditional ICAP generators that did not get scheduled in the Day-Ahead Market to offer into the Real-Time Market. However, they are required to respond to a Supplemental Resource

Evaluation (SRE) request in real-time regardless of whether they got picked up in the Day-Ahead Market. SRE is a manual operator action and inherently involves operator judgment, and does not guarantee lowest production cost. Given the expected size and number of DER, it is operationally challenging to SRE these resources in real-time if they do not clear in the Day-Ahead Market without the development of additional tools. Consistent with the obligations of the traditional generators, the NYISO believes that DER with a Capacity Obligation must also be available in real-time for the amount of capacity sold into the capacity market.

The NYISO intends to establish a minimum notification time for DER that allows access to commit these resources in real-time even if a day-ahead schedule does not exist. The expectation is that the minimum notification time is consistent with the REV goals to animate the grid and will give the NYISO operational flexibility and ability to commit and de-commit these resources as system conditions change.

As part of this effort, the NYISO also plans to evaluate minimum thresholds specific to DER for other offer parameters, such as minimum down time, minimum run time and response rate. Minimum down time in the context of load curtailment assets would mean the time between consecutive interruptions and possibly include consideration on maximum interruptions in a day. The thresholds for the minimum run time for DER would mean the minimum time the resource will be dispatched by the Real-Time Dispatch software. Response rate would translate into how fast the resource can reach its upper operating limit within the minimum runtime.

Comparable to traditional generators, DER will be required to be available based on the offers that they submit to the NYISO. If they are limited or unavailable, they must report a derate to NYISO's outage scheduling software. Given the expected size and number of DER, the current outage reporting platforms the NYISO utilizes will need to be modified to accommodate DER.

The NYISO recognizes that some Market Participants will want to aggregate various resource and technology types in a DER aggregation in order to provide flexibility to the Market Participants; the NYISO expects to allow Market Participants to manage the performance from various resource types in order to meet the requirements discussed above. As an example, a 24-hour DER might rely on load curtailment assets to provide "supply" during the day time and generation assets during the night time. If dispatched for four hours, the Market Participants may choose to meet their obligations by discharging from storage devices for two hours and by load curtailment for another two hours. The DER program performance obligations will be at the aggregation level, and not at individual resource level for resources that are part of the aggregation.

	Traditional Generator with Capacity Obligation	DER with Capacity Obligation
Products (if qualified)	<i>Energy, Capacity and Ancillary Services</i>	<i>Energy, Capacity and Ancillary Services</i>
Day-Ahead Market	<i>Must-offer for 24 hours</i>	<i>Must-offer for 24 hours for Full Day service (Prorated capacity and associated payments for daytime and peak time service)</i>
Real-Time Market	<i>Must be available in real-time</i>	<i>Must be available in real-time</i>
Activation	<i>Economic Dispatch or Self-Schedule</i>	<i>Economic Dispatch or Self-Schedule</i>

DER without Capacity Obligation

DER that are unable to commit to fulfill NYISO Capacity market obligations, but still want to be economically scheduled by the NYISO, can choose to offer into the Energy and Ancillary Services markets. DER that are participating only in the Energy and Ancillary Service market will be expected to follow similar obligations as traditional generators have when they are only participating in the Day-Ahead and/or Real-Time Markets.

IV. Measurement and verification

DER operating within the NYISO's Energy or Ancillary Services markets would be dispatched in a manner similar to that of traditional generators. As such, these resources would necessarily be held to comparable compliance obligations as traditional generators. Failure of DER to perform as scheduled in the markets would have cost implications for consumers and potentially impacts on grid reliability. The NYISO will work to develop performance criteria and compliance metrics for the DER program that are comparable to those in place for traditional generators, including such metrics as base point deviation charge and other associated performance standards.

Metering and telemetry requirements

Individual demand response resources in the SCR program and EDRP are typically not market participants themselves (i.e., they are neither NYISO customers nor suppliers that are modeled in the NYISO's MIS). The NYISO has developed the Demand Response Information System (DRIS) to manage the enrollment and performance details of individual demand response resources. Currently, the DRIS captures only the individual DR resource meter data required to support the administration of enrollment and limited data for measurement and verification of event response. Market Participants provide pre-calculated values that the NYISO uses in the process of measurement and verification and settlement. This limited amount of data is reported to the NYISO by the Market Participants that enroll the DR resources for the demand response programs and may be sourced from interval meters installed by the distribution utility or shadow metering devices installed by the Market Participant or a third party. There is a significant delay in receiving data to verify response in a demand response event, which limits the NYISO's ability to analyze the data in any detail or to evaluate the response until almost three months

after the event. Existing demand response programs suffer from a lack of meter data, which impacts analysis, program design, and measurement and verification capabilities.

The NYISO's current infrastructure for meter data supports PTID-level data of large supply resources, primarily collected through telemetry for real-time operations and monitoring functions, and after-the-fact uploads to support settlement. The integration of DER into Energy and Ancillary Service markets is expected to follow the same model. The NYISO will require DER to provide PTID-level real-time telemetry data for operations and monitoring functions, and after-the-fact meter data from individual resources for settlements. As part of this roadmap the NYISO intends to explore the use of real time telemetered data from a sample set of resources participating as a DER aggregation.

For resources that are using on-site generation and/or storage, the NYISO will consider requiring after-the-fact meter data from two of the following: net meter, load meter, generator/storage meter.

Currently, the NYISO requires Market Participants to have the utility or a New York State PSC-certified Meter Data Service Providers or Meter Service Providers to read the interval meters. The NYISO recognizes that this is a potential barrier for DER to enter the market and hopes to explore options to address this barrier as the DER program evolves.

Resources participating in the DSASP currently have an option to directly communicate the telemetry signals with the NYISO or via the Transmission Owner. The NYISO expects to follow the same model for the DER program. Similar to the current DSASP construct, the NYISO intends to only specify requirements for the NYISO and Aggregator communications, and leave it flexible for the Market Participants to determine which technology they use to communicate with its resources. The NYISO currently has a program-wide enrollment limit of 200 MW for DSASP using direct communications primarily to reduce the operational exposure during the Interim Control Operations (ICO) condition. With the creation of the DER program, the NYISO intends to evaluate options to reduce this operational risk and thereby increase the enrollment limit for direct communication.

Metering communications infrastructure is comprised of two key components: the network over which the information is transmitted and the application protocol used to carry the message over the network; in order to be considered for real-time use they both will need to be reliable and secure. In order to reduce the technological burden of entry, the NYISO would consider allowing the use of public internet as the network for Market Participants with a limited number of MW participating in the DER program. In addition to the ICCP as the application protocol, the NYISO would consider options to allow other application protocols such as DNP3.

The after-the-fact meter data for individual DER will help in verifying baselines for demand side resources that are part of a DER Aggregation PTID. The NYISO plans to work on establishing timelines of meter data submission that is consistent with other supply resources.

Baselines

The NYISO conducted a Baseline Study³ in 2014 with DNV GL to investigate baseline methodology for the SCR program. The NYISO plans to draw on conclusions of that study. Notably, the study

³

http://www.nyiso.com/public/webdocs/markets_operations/market_data/demand_response/Demand_Response/Special_Case_Resource_ICAP_Program/NYISO%202013%20SCR%20Baseline%20Study%20Report-final.pdf

recommended that the Average Coincident Load (ACL) baseline should be used to determine the upper limit on the amount of capacity that could be offered by the DER, and that Customer Baseline Load (CBL) should be used to measure performance for an energy product. If a DER participates in the Ancillary Services market, it is expected that the NYISO will use the current DSASP baseline to evaluate performance for the ancillary product. The NYISO will work on establishing detailed market rules for measuring the performance of a resource that is simultaneously providing energy and reserve products.

In addition, the 2014 DNV GL Baseline Study recommended some potential enhancements for the CBL, specifically related to the exclusion rules when determining the CBL, and the caps on the in-day weather adjustments. The NYISO intends to incorporate these recommendations when establishing the baselines for the DER program. In addition, the NYISO also intends to evaluate establishing baselines for behind-the-meter energy storage resources.

As part of the DER program, the NYISO plans to accommodate baselines from different technologies and load types, including baselines for mass residential and small commercial customer classes. For example, CBL for a highly variable load could be different from a load with a high load factor. The SCR program does not allow for energy to be injected into the grid and thus the current CBL methodology may not be sufficient to measure injections. The NYISO will work on establishing market rules to measure injections as necessary.

Aggregation and Modeling

Unlike the traditional wholesale generators, which are primarily connected to the transmission grid, many of the DER will be connected to the distribution networks. To ensure bulk power system reliability, it is important to accurately represent DER impacts at their corresponding interface to the bulk power system, which is typically at the transmission substation load bus/PTID associated with that distribution network. This granular modeling of the DER will also help ensure the DER compensation in the wholesale markets reflects the locational and temporal value the DER in addressing the transmission congestion on the bulk power system.

Based on the experience in the NYISO's existing DR programs, the NYISO recognizes the benefits of allowing Market Participants to aggregate DER to meet the eligibility requirements and also the performance requirements. The existing economic DR programs allow Market Participants (through self-representation, represented through a third-party aggregator, or the distribution platform service provider in the future) to aggregate resources to meet the 1 MW minimum eligibility requirements. Each aggregation is modeled and represented by a PTID in the NYISO systems. The NYISO typically makes model updates a few times each year. The NYISO typically needs 60-90 days advanced notice to incorporate new resources into the model.

The NYISO intends to retain the concept of aggregations with the following additional considerations:

- Individual resources that have significant impact on the bulk transmission system reliability and congestion and will be modeled as individual resources at their corresponding transmission interface location. The NYISO will consider an upper limit on aggregation size to ensure system reliability and provide flexibility. Resources that are below the above specified threshold could be aggregated within a pre-defined sub-zonal boundary. The sub-zones will be identified based on the historical transmission congestion patterns to ensure DER impact on the transmission

reliability is accurately represented. Locations for modeling aggregations within a zone/subzone will be chosen to best reflect the impact they have on the system.

- In order to avoid local distribution system reliability issues, the injections of the DER into the grid through the DER program will be subject to the interconnection procedures applicable to that resource. Resources that only reduce the load being consumed and do not inject into the grid would not be subject to the interconnection procedures to participate in the DER program. The NYISO intends to review its planning models regarding how we represent the cumulative impact of DER aggregations and resources. NYISO models may need to be updated to account for the potential addition of hundreds to thousands of DER program resources comprising multitude of aggregations and system PTIDs.

Settlements & cost allocation

The design of the settlement and cost allocation rules for the DER program will need to consider Order 745 compliance, including compensation based on the Net Benefits Test concept.

All the settlements for the DER would be at their applicable PTID and will follow the same settlement timelines as traditional generators.

The NYISO currently has special settlement provisions for the electricity consumed to charge the storage devices participating as Limited Energy Storage Resources (LESR). The NYISO will consider evaluating if additional settlement rules would be required for the electricity consumed to charge behind-the-meter storage devices participating in the DER program.

V. Simultaneous participation in retail/distribution-level programs

Many of the DER will be connected to the distribution networks and capable of providing distribution level services such as feeder unloading service to its distribution service provider. Some DER may choose to participate in NYISO's wholesale markets and provide services to the wholesale markets. The Behind-the-Meter Net Generation market rules do not permit resources to simultaneously participate as wholesale resources in NYISO markets and also in retail programs. The NYISO recognizes that there may additional value streams for DER with the simultaneous participation in the NYISO and retail programs. However, there are several operational, market, and legal challenges that must be addressed prior to allowing dual participation. An example of such a challenge is the resource potentially having multiple masters who send the dispatch/pricing signals that and may or may not be coordinated, forcing the resource to choose which signal to follow. The resource's response to these multiple signals could lead to wholesale or retail/local operational and reliability issues. Enhanced planning, operational, and market coordination would be required between the NYISO and the distribution utility. The NYISO intends to review these operational and market challenges and explore options to address them in the context of this DER roadmap.

VI. Other Considerations

For DER that are using storage devices to facilitate participation, the NYISO would consider options to receive the storage's current State-of-Charge (SOC) level from the DER through real-time telemetry to provide State-of-Charge management. Additionally, the NYISO is looking into other tools for storage participation in its Energy Storage Integration and Optimization effort. These tools would be made available to DER if they are found practical and useful for DER energy management.

The NYISO has asked for clarification from the Northeast Power Coordinating Council (NPCC) to confirm that resources that rely on inverter technology, such as batteries, can provide synchronous reserves. The NYISO intends to use this clarification from NPCC as it formulates the DER eligibility requirements for providing synchronous reserves.

Some DER may utilize technologies that are capable of supplying leading and lagging VARs to the bulk system. If a DER wishes to qualify for Voltage Support Service (VSS), they will be subject to all of the tariff and manual requirements that apply to current service providers.

The NYISO will consider establishing generic reference prices for DER offering in the energy market. If a resource or aggregation can demonstrate differing costs, they can consult with the NYISO's Market Mitigation and Analysis Department for an adjusted reference price.

The NYISO will also evaluate how load served by DER operating at the time of the system peak will be incorporated into load forecasts and LSE capacity obligations.

The NYISO will be evaluating the appropriate penalty structure for the DERs, including penalties for non-performance.

VII. Transition plan

The DER roadmap is intended to be a starting point for the conversations with stakeholders to develop the detailed program rules, requirements and software. This is an effort that will take several years to develop and implement. The programs currently in place will continue “as is” for the immediate future. As this collaborative conversation with stakeholders continues, there may be some interim or transitional changes made to the existing demand response programs. Ultimately, the DER program may supersede the economic demand response programs (DSASP and DADRP), as the new program will offer similar benefits with increased features and flexibility. The reliability-based Demand Response programs (SCR and EDRP) are expected to continue, with some changes to better align these programs with the DER program.

	Distributed Energy Resources			Price Capped Load Bidding
	Dispatchable DER	SCR	EDRP	
	Full, Daytime, Peak	4 Hour Reliability	Voluntary Reliability	
DAM Energy	Fully Dispatchable ✓ Bidding required if Capacity is sold	4 Hour Minimum Reliability ✗	Voluntary Reliability ✗	✓
RT Energy	consistent with short notice generators ✓	payment available for verified performance ✓	payment available for verified performance ✓	✗
Capacity	✓	✓	✗	✗
Ancillary Services	✓	✗	✗	✗
30 Min Non Sync	must offer if resource aggregation is qualified	NA	NA	NA
10 Min Non Sync	must offer if resource aggregation is qualified	NA	NA	NA
10 Min Spin	must offer if resource aggregation is qualified	NA	NA	NA
Regulation	Optional depending on qualifications	NA	NA	NA
Voltage Support	Optional depending on qualifications	NA	NA	NA

Figure 2.

VIII. Other Supporting Initiatives

NYISO Pilot Framework

The NYISO will develop a framework to enable a series of small pilot projects of limited scope to test and gain an understanding various components of the integration of various new technologies into the NYISO systems. The intent is to gain better understanding of the new technologies and use that learning to

develop detailed market rules and tariff changes for the full integration of these newer technologies into the NYISO markets and operations.

REV Demonstration Support

The PSC's REV proceeding has required that distribution utilities develop, propose, and implement demonstration projects to advance the goals of the proceeding by deploying DER solutions to investment needs. The NYISO is working closely with the utilities as they develop these demonstration initiatives to support any efforts that require coordination or integration with bulk power system operations or wholesale markets.

Granularity of Pricing

Price transparency is a critical element of animating markets and encouraging market participants to adjust their electricity consumption in response to system needs. Whereas the SCR program is activated manually with a call to participants to deliver their demand response during an upcoming period of time, the DER program model automates these actions on the basis of price signals and the participant's economic willingness to consume electricity from the grid. But, this economic willingness needs to be informed by actionable information.

Presently, the NYISO delivers real-time price signals, calculated every five minutes, at the zonal level for Load. However, price signals provided at this level are effectively an amalgamation of sub-zonal price signals that reflect differing conditions within a given zone. These sub-zones and load pockets within the zone may be experiencing conditions that are not necessarily reflective of the zonal price. Pricing at the zonal level, therefore dilutes incentives for DER that could otherwise provide significant benefits to the grid and the market. To facilitate more economically efficient DER activity, there is a need to expose DER to more granular price signals reflective of location specific system conditions. These more granular price signals are available to the NYISO, but have not to date been delivered to the market based on current market design. To enable this, DER sites that choose to participate in the NYISO's Energy and Ancillary Services markets will need to be mapped to their appropriate electrical buses and settled at the nodal price associated with the bus. The NYISO's goals will be to deliver real-time nodal LBMPs, calculated every five minutes, to better utilize price signals to reflect more localized system conditions. The NYISO is currently posting a limited set of these nodal load prices at select locations around the state as part of a pilot initiative. These granular prices are not intended to be used for wholesale Load settlements.

Business Model Recommendation

Guiding development of the DER program business model is the notion that the resulting market products must provide NYISO grid operators with a set of tools that offer enhanced grid reliability to ensure the normal and emergency operation of the power system using flexible resources. The goal will be to replace the NYISO's existing economic-based demand response initiatives while potentially transitioning resources out the current reliability-based SCR product. The NYISO envisions a market design that works together with all Energy, Capacity, and Ancillary Services market rules currently in place, with the goal of offering operators the ability to dispatch and control all DER participating in the wholesale market. A transition plan will need to be outlined to facilitate the move from existing economic-based demand response programs to the new DER program concept, as well as any changes that may be needed in the SCR program with respect to performance obligations and capacity payments. Among the considerations for performance criteria will be daily must-offer requirements, minimum performance durations, minimum

notification time requirements, aggregation level performance requirements, and offer floor and ancillary services in real-time.

Meter Data Policy

One of the key challenges to participation of DER in NYISO markets is measuring and verifying the performance of the resources in order to accurately compensate for the value they contribute to grid operations. DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure. Establishing the baseline will require estimating a participant's load through the collection of data for days in advance of response events to establish an average load profile. The participant's performance, and ultimately compensation, will reflect the deviation of its load from that estimated baseline.

Behind-the-meter generators and storage devices further complicate by potentially obfuscating the baseline demand and making it more difficult to assess DER's performance. A policy for meter data and metering requirements will be critical to ensuring the integrity of the market. The ability for the NYISO to measure gross generation and gross native load at DER sites participating in NYISO markets will be necessary to ensure that the market is properly compensating DER for their contribution to system needs. The NYISO proposes to work with stakeholders to devise and specify acceptable metering configurations and reporting requirements in compliance with meter data protocols.

Currently, the NYISO requires Market Participants to have utility or a PSC-certified Meter Data Service Provider or Meter Service Provider to read the interval meters. The NYISO recognizes that this is a potential barrier for DER to enter the market and hopes to explore options to address this barrier as the DER program evolves.

Market Price Delivery

The NYISO will continue to post pricing data on its website in CSV file format, as well as in maps and graphical forms. The NYISO plans to explore other options including Automated Programmatic Interfaces (API) for sharing and transfer of nodal pricing.

IX. Next Steps

The fundamental premise behind the NYISO's proposed DER program initiative is straightforward: competitive markets and system operations will benefit from access to emerging technologies that, when integrated into the NYISO's market structures, can adjust demand on an economic basis in response to price signals from the market. However, developing and implementing such an initiative will entail a considerable amount of time, effort, and stakeholder engagement.

The NYISO is seeking feedback on its roadmap as a first step and will work with stakeholders to refine the roadmap and begin formal discussions to develop market design elements, functional requirements, and tariff language necessary to implement its vision for the DER program.

Appendix A – Use Cases for DER in Wholesale Markets

Fixed Load Consumers

This consumer can be thought of as the consumer of today, where there is essentially zero ability to affect any change to their power consumption based on price/dispatch signals. This consumer prefers to simply use power when they want, how they want and will pay for their usage as is. They prefer to not be bothered with thinking about or to be inconvenienced by any type of load reduction or shifting due to power prices at that time.

Fixed load

Small residential customer, no controls, may have solar panels, pays weighted zonal price, no advanced metering

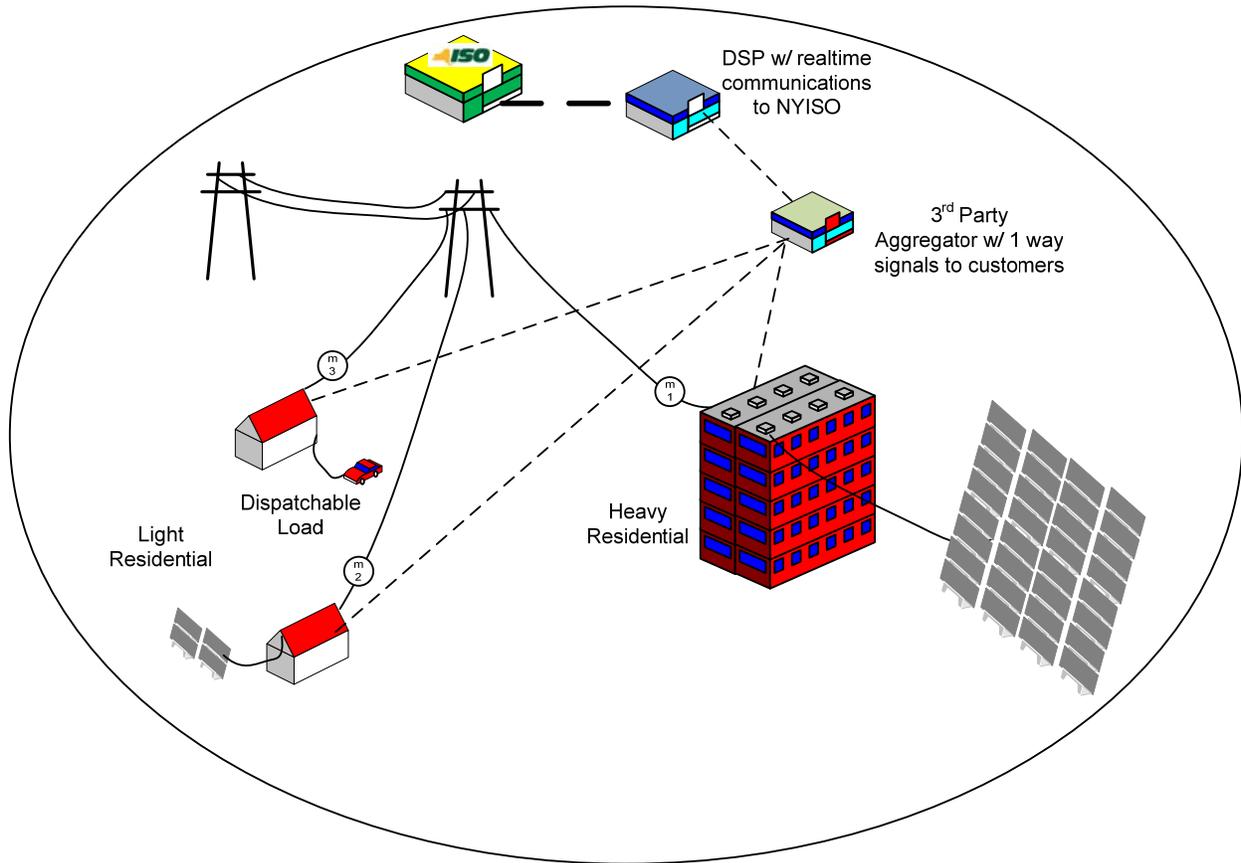
DER Prosumers

This prosumer is price minded and is willing to make investments of time and/or dollars to experience a cost savings by re-acting to a pricing signal.

DER Prosumer Use Cases

#	Type	Description
1	Dispatchable Load	An aggregation of small to large size residential customers with dispatchable load only
2	Dispatchable Load	Similar to #1 but there is no aggregation
3	Dispatchable Load and Generation	An aggregation of small to large size residential customers with dispatchable load and generation with electronic communications going through the aggregator
4	Dispatchable Load and Generation	Similar to #3 but there is no aggregation and electronic communications are direct to the DSP
5	Dispatchable Load and Storage	Similar to #3 except generation is replaced with storage
6	Dispatchable Load and Storage	Similar to #4 except generation is replaced with storage
7	Dispatchable Load, Storage and Generation	Similar to #3 except it includes storage
8	Dispatchable Load, Storage and Generation	Similar to #4 except it includes storage

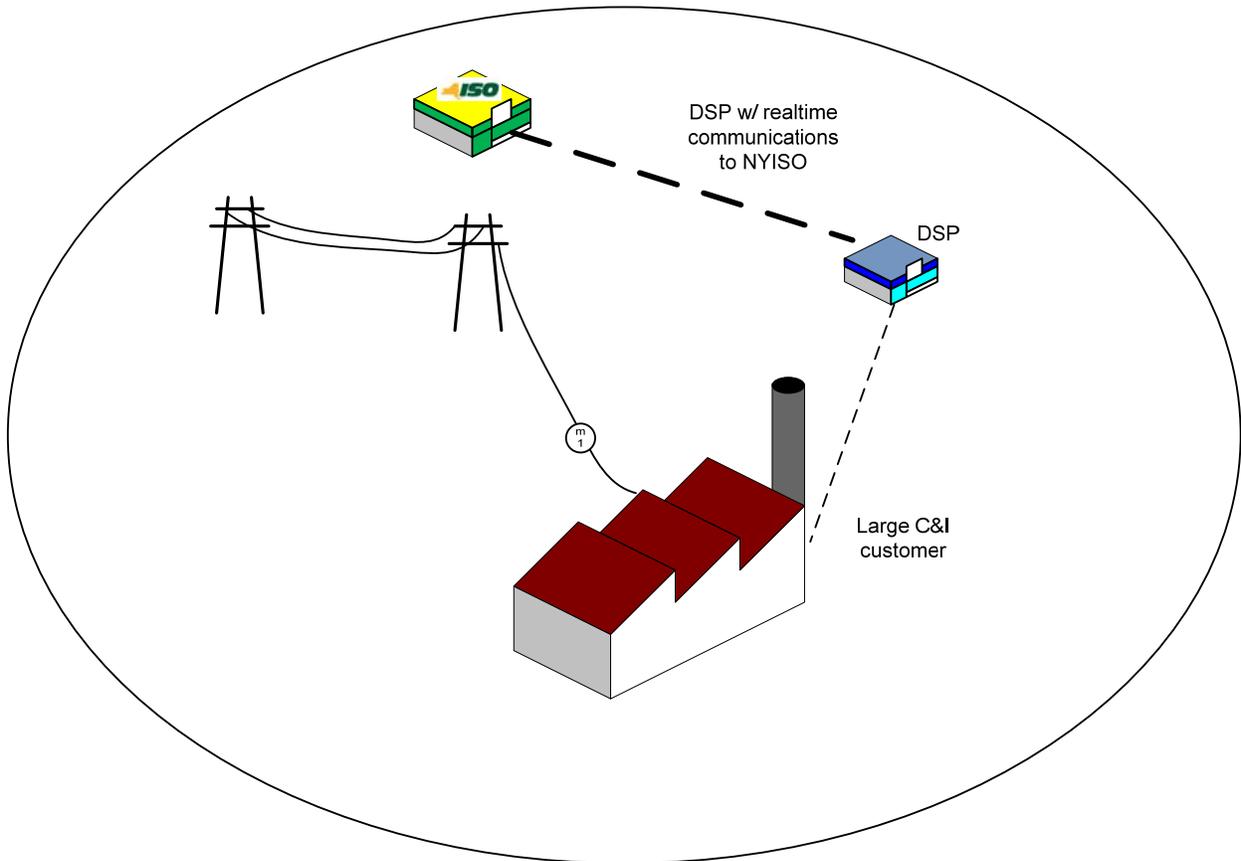
Use Case 1 - Dispatchable Load



Participant(s)	Small to large size residential customers
Features	Partially sophisticated load
Metering	Interval metering
Signaling	Partially sophisticated notifications to curtail load
Dispatchable	Partial load
Aggregated	Yes
Services	Energy and possibly Capacity (EDRP or SCR)
Telemetry Communications Path	N/A
Notes	

[Return to Use Case List](#)

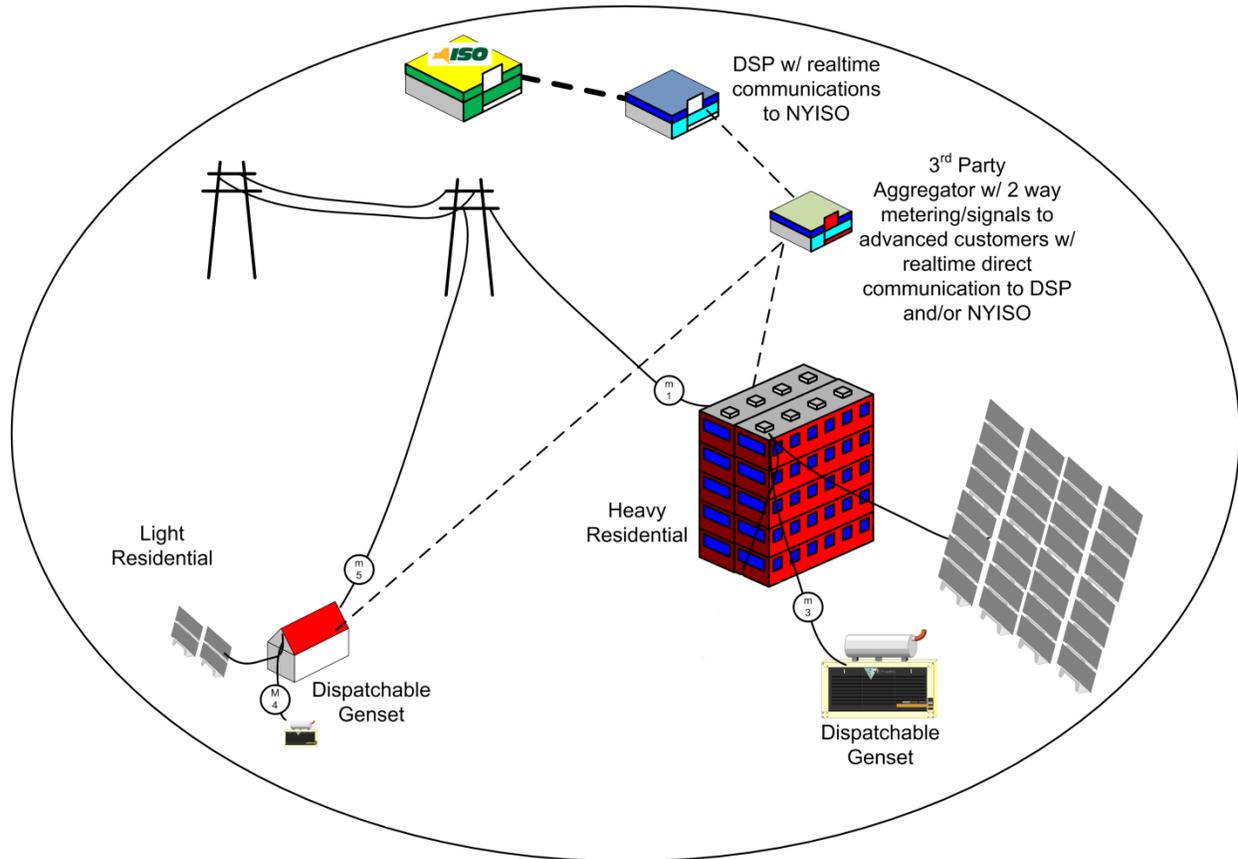
Use Case 2 - Dispatchable Load



Participant(s)	Medium to large size residential customers
Features	Partially sophisticated load
Metering	Interval metering
Signaling	Partially sophisticated notifications to curtail load
Dispatchable	Partial load
Aggregated	No
Services	Energy (EDRP)
Telemetry Communications Path	N/A
Notes	Similar to #1 but there is no aggregation

[Return to Use Case List](#)

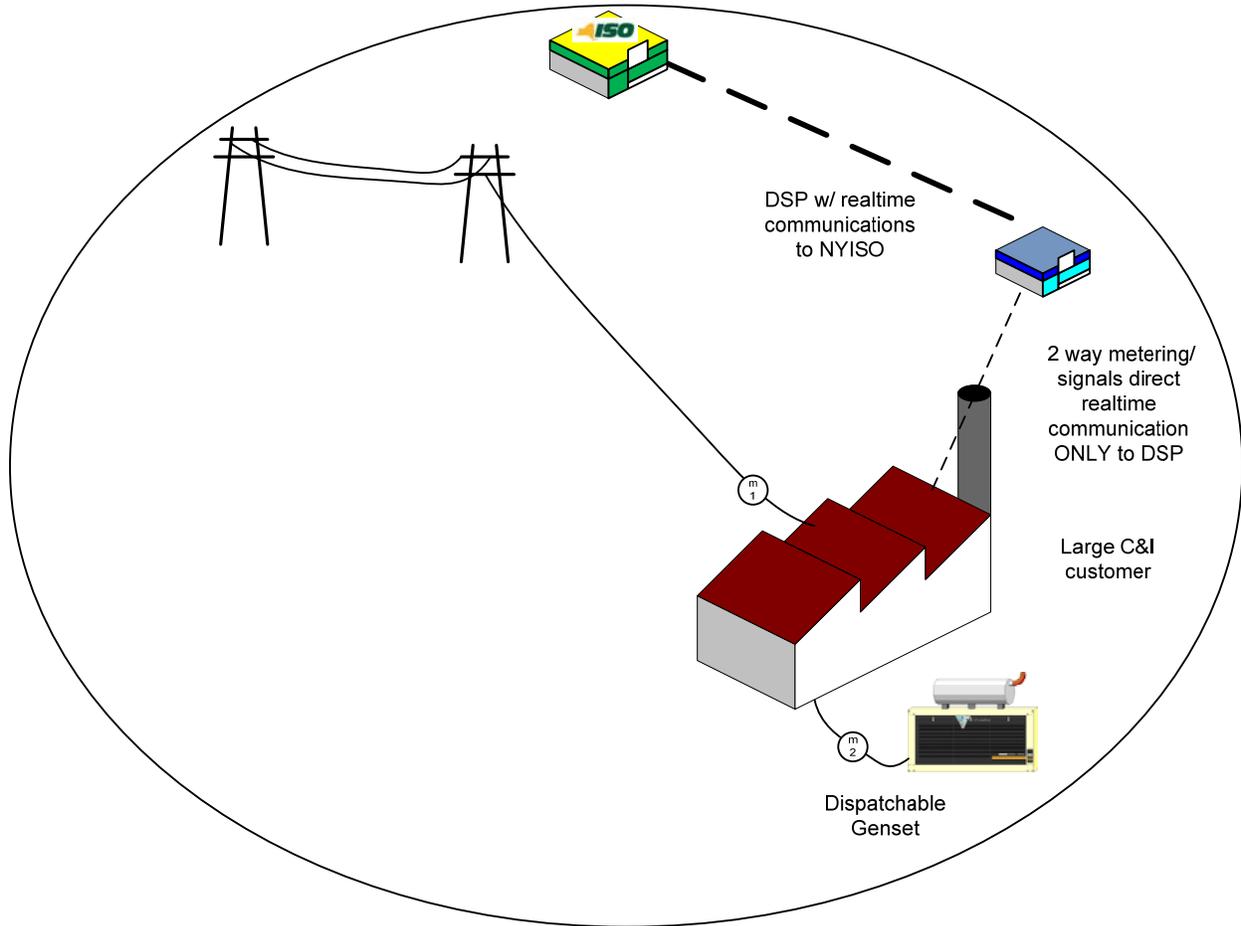
Use Case 3 - Dispatchable Load and Generation



Participant(s)	Small to large size residential customers
Features	Sophisticated load and sophisticated generation
Metering	Real-time metering with telemetry
Signaling	Capable of sophisticated notifications to curtail load and/or activate other services as instructed
Dispatchable	Load, storage & generation
Aggregated	Yes
Services	Energy, Capacity and Reserves
Telemetry Communications Path	Aggregator -> DSP -> NYISO
Notes	

[Return to Use Case List](#)

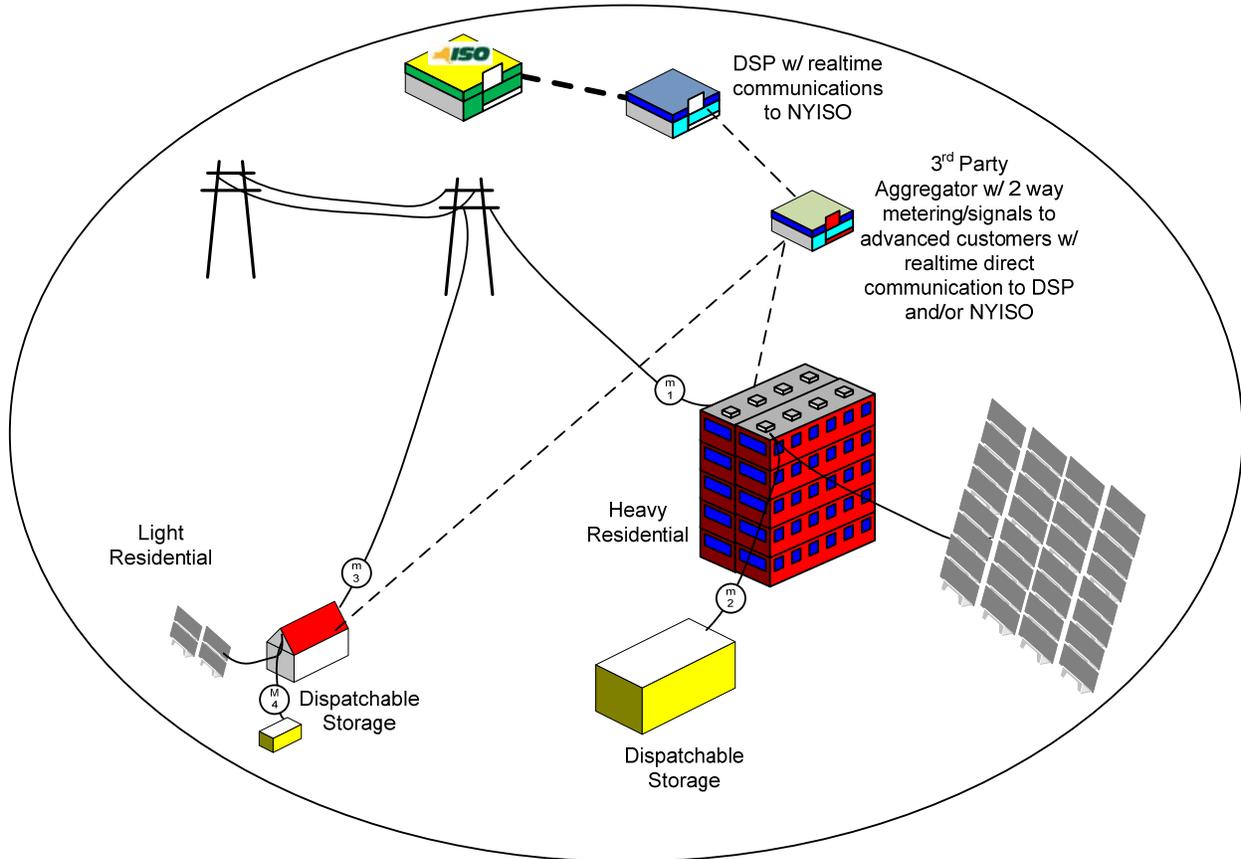
Use Case 4 - Dispatchable Load and Generation



Participant(s)	Medium and large size C&I customers
Features	Sophisticated load and sophisticated generation
Metering	Real-time metering with telemetry
Signaling	Capable of sophisticated notifications to curtail load and/or activate other services as instructed
Dispatchable	Load & generation
Aggregated	No
Services	Energy, Capacity, Reserves
Telemetry Communications Path	Aggregator -> DSP -> NYISO
Notes	Similar to #3 but there is no aggregation and electronic communications are direct to the DSP

[Return to Use Case List](#)

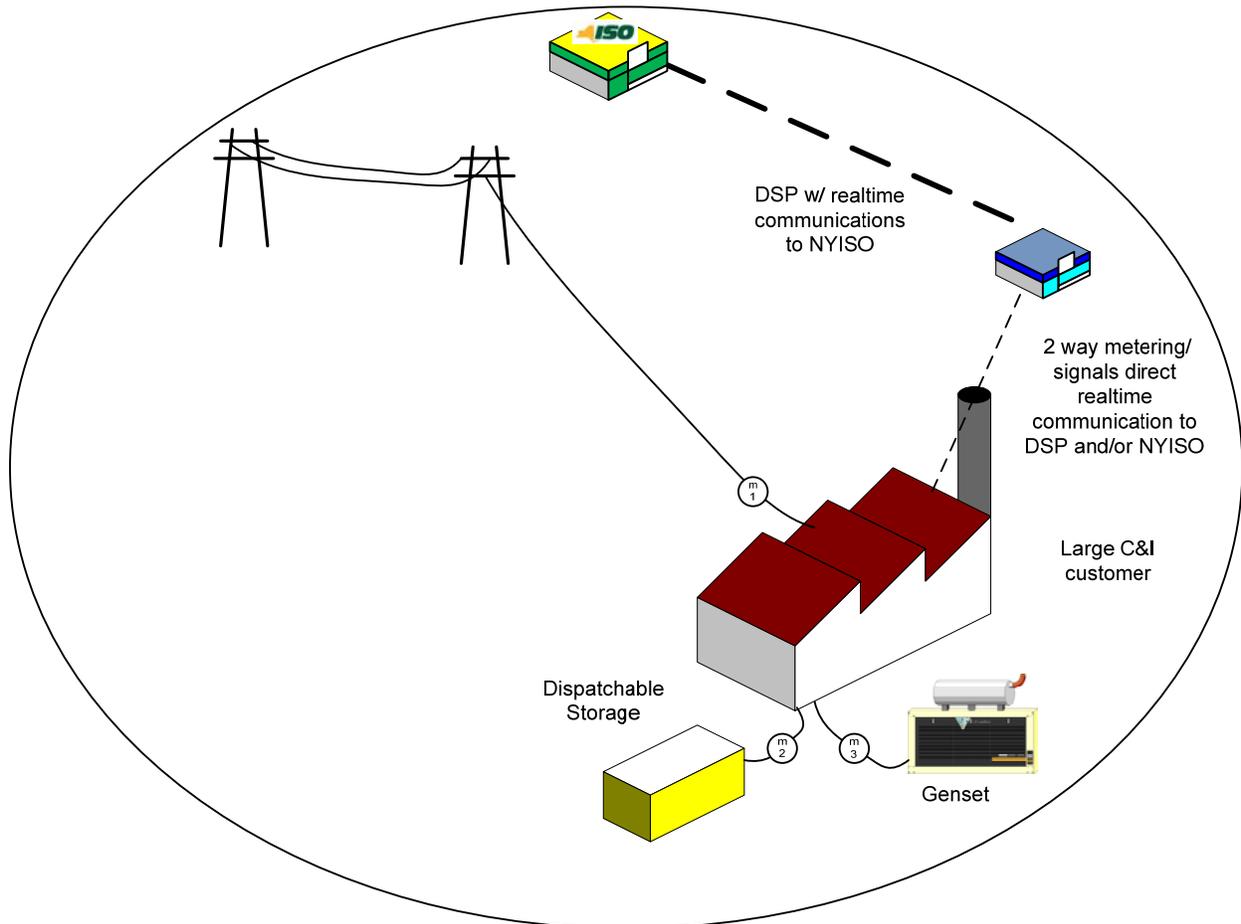
Use Case 5 - Dispatchable Load and Storage



Participant(s)	Small to large size residential customers
Features	Sophisticated load and sophisticated storage
Metering	Real-time metering with telemetry
Signaling	Capable of highly sophisticated notifications to curtail load and/or activate other services as instructed
Dispatchable	Load & storage
Aggregated	Yes
Services	Energy, Capacity, Reserves, Regulation
Telemetry Communications Path	Aggregator -> DSP -> NYISO
Notes	Similar to #3 except generation is replaced with storage

[Return to Use Case List](#)

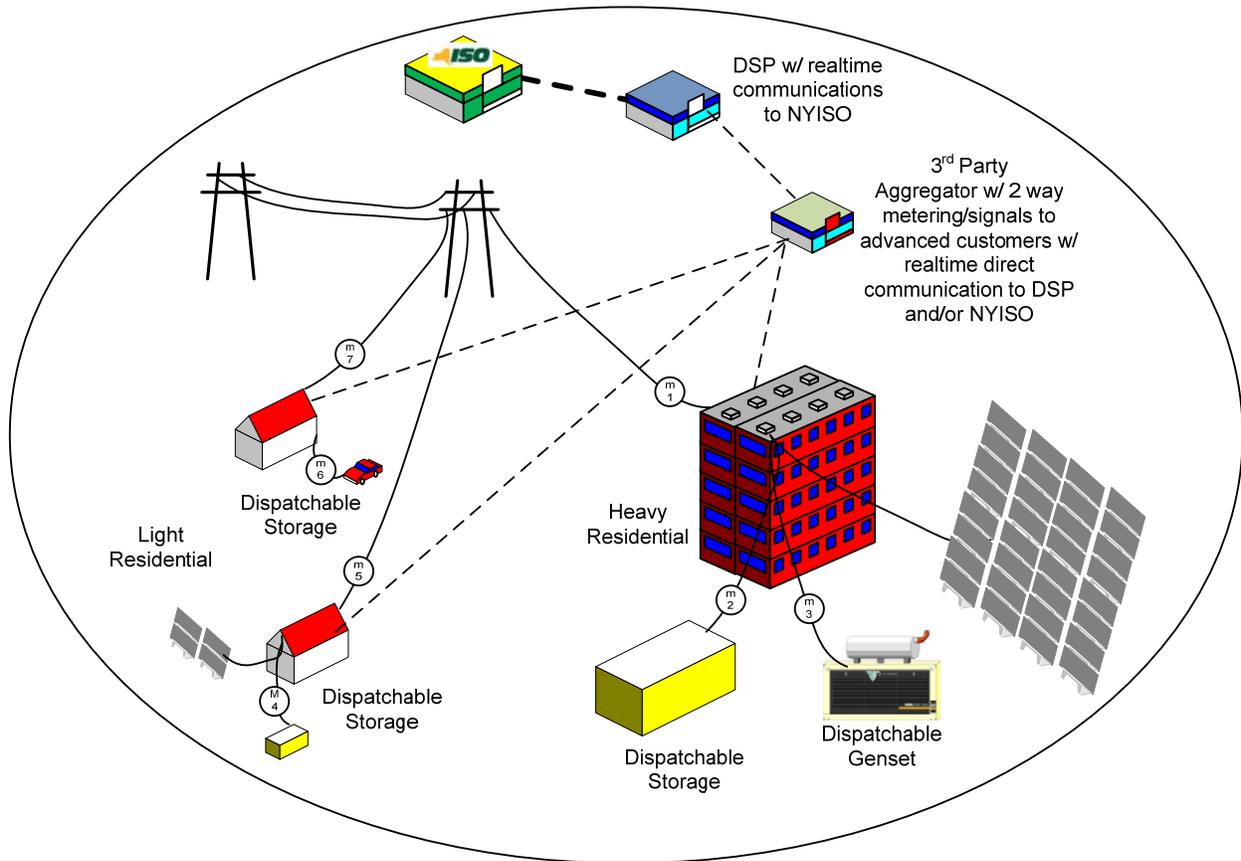
Use Case 6 - Dispatchable Load and Storage



Participant(s)	Medium and large size C&I customers
Features	Sophisticated load and sophisticated storage
Metering	Real-time metering with telemetry
Signaling	Capable of sophisticated notifications to curtail load and/or activate other services as instructed
Dispatchable	Load & storage
Aggregated	No
Services	Energy, Capacity, Reserves, Regulation
Telemetry Communications Path	Aggregator -> DSP -> NYISO
Notes	Similar to #4 except generation is replaced with storage

[Return to Use Case List](#)

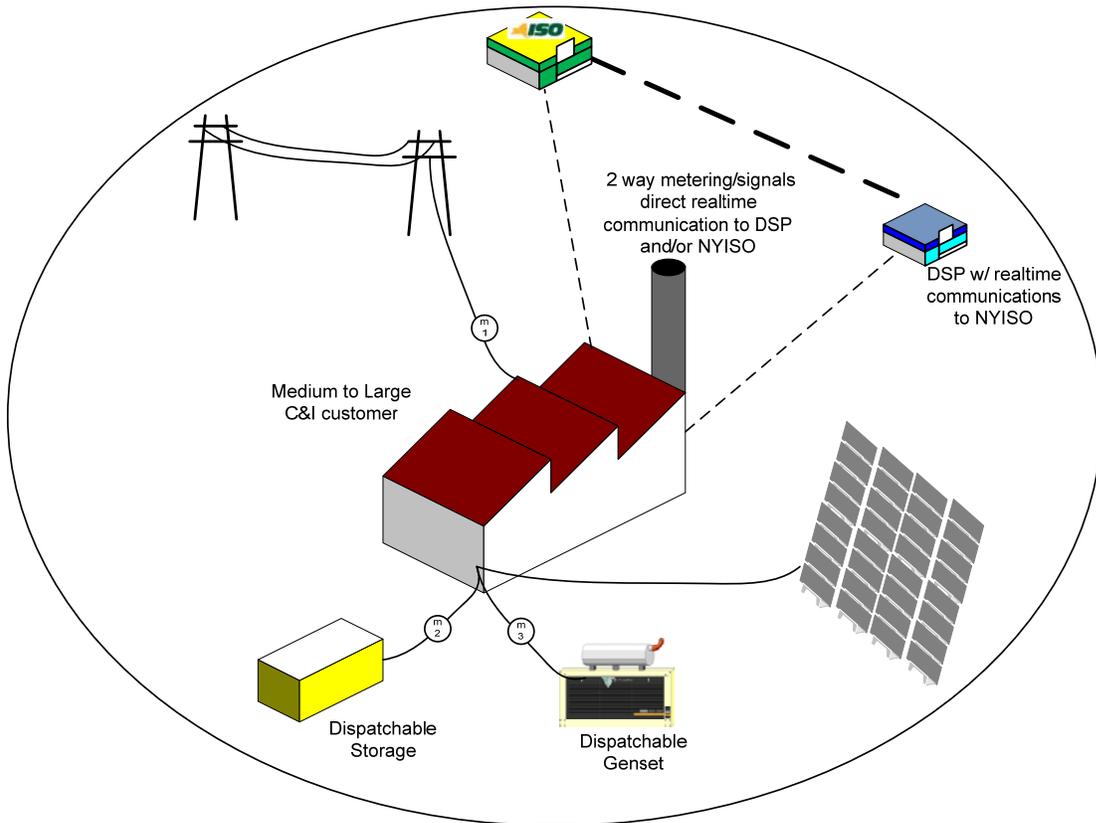
Use Case 7 - Dispatchable Load, Storage and Generation



Participant(s)	Small to large size residential customers
Features	Sophisticated load, sophisticated storage and sophisticated generation
Metering	Real-time metering with telemetry
Signaling	Capable of sophisticated notifications to curtail load and/or activate other services as instructed
Dispatchable	Load, storage & generation
Aggregated	Yes
Services	Energy, Capacity, Reserves, Regulation
Telemetry Communications Path	Aggregator -> DSP -> NYISO
Notes	Similar to #3 except it includes storage

[Return to Use Case List](#)

Use Case 8 - Dispatchable Load, Storage and Generation



Participant(s)	Medium to large size C&I customer
Features	Sophisticated load, sophisticated storage and sophisticated generation
Metering	Real-time metering with telemetry
Signaling	Capable of sophisticated notifications to curtail load and/or activate other services as instructed
Dispatchable	Load, storage & generation
Aggregated	No
Services	Energy, Capacity, Reserves, Regulation
Telemetry Communications Path	Aggregator -> (DSP and NYISO) <u>OR</u> (Aggregator -> DSP -> NYISO)
Notes	Similar to #4 except it includes storage

[Return to Use Case List](#)