2017 DER Market Design Concept Proposal Summary

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Market Issues Working Group (MIWG)

December 19th, 10 Krey Boulevard

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Purpose of Today's Meeting

- **Review the Distributed Energy Resource (DER) Market Design Concept Proposal (MDCP)**
  - DER Proposed Definition
  - Aggregations
  - Measurement & Verification
  - Performance Obligations
  - Dual Participation

Background

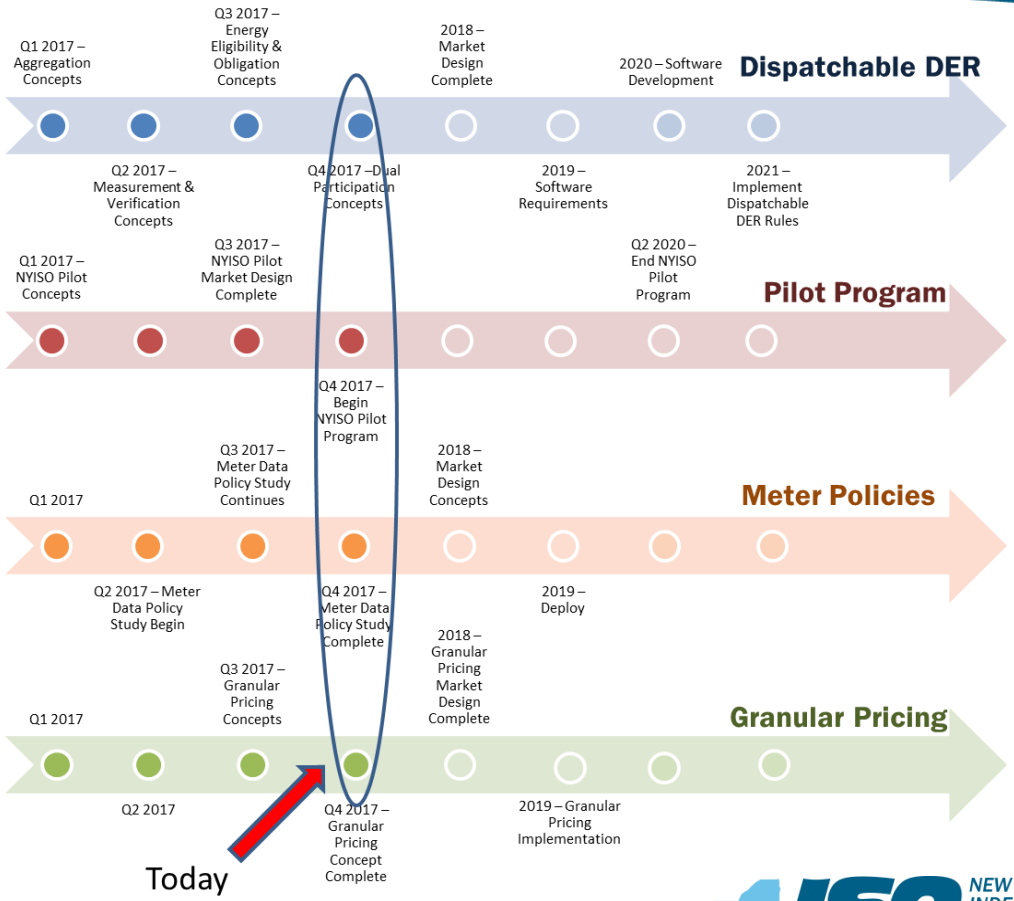
Date	Working Group	Discussion points and links to materials
02-02-17	Posted	Distributed Energy Resources Roadmap for New York's Wholesale Electricity Market
02-28-17	Market Issues Working Group (MIWG)	DER Roadmap: Aggregation Participation Model
04-24-17	Market Issues Working Group (MIWG)	DER Roadmap: Aggregation Participation Model
05-23-17	Market Issues Working Group (MIWG)	DER Roadmap: Measurement & Verification, Monitoring & Control and Meter Data Study
06-21-17	Market Issues Working Group (MIWG)	DER Roadmap: Eligibility and Performance Obligations
07-31-17	Market Issues Working Group (MIWG)	DER Roadmap: Eligibility and Performance Obligations
09-29-17	Market Issues Working Group (MIWG)	DER Roadmap: Eligibility and Performance Obligations, Dual Participation
10-30-17	Market Issues Working Group (MIWG)	DER Roadmap: Aggregations & Dual Participation

Purpose of the DER Roadmap Effort

- Develop a Dispatchable DER Participation Model for the NYISO-administered wholesale markets
- Create a model that supports the **NYISO Market Design Vision** - *Attract and retain the most efficient resources to meet NY's reliability needs*

Timeline

DER Roadmap



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MDCP Development

- **The MDCP describes the creation of a participation model for DER, including:**
  - Defining a new wholesale market resource type;
  - Developing a model for aggregating resources behind a transmission node to facilitate wholesale market participation;
  - Evaluating options for appropriate Measurement & Verification (M&V) and Monitoring and Control (M&C);
  - Identifying appropriate performance standards for DER; and
  - Laying out a potential path forward for DER to participate in both the wholesale markets and in retail (distribution system) programs
- **The remaining concepts not fully developed in 2017 will be addressed in 2018 during tariff drafting**

DER

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DER Definition for the Market Design Concept Proposal

- DER shall be defined as "resources qualified to participate in NYISO's Energy, Ancillary Services, and/or Capacity markets that are (i) capable of changing their load, or (ii) capable of injecting 20 MW or less onto the transmission and/or distribution system, at the NYISO's direction."
- Dispatchable DER are a subset of DER that are capable of responding in real-time (at least on a five-minute basis) to NYISO directions.

DER Market Participation

- The MDCP NYISO proposes allows DER to utilize different participation models
- The participation model used by a DER will be determined by its capabilities and how it chooses to aggregate

DER Participation Models

- **Aggregations may be homogeneous or heterogeneous**
  - Heterogeneous aggregations will be subject to the rules developed using this MDCP
  - Except for Demand Side Resources, homogeneous aggregations will be subject to the rules of the particular in front of the meter resource type (*i.e.,* Generator, energy storage resource, Intermittent Power Resource)
    - Dispatchable Demand Side Resources will be subject to the rules developed using this MDCP;
    - Non-dispatchable Demand Side Resources may continue to participate in the EDRP or SCR Program

Participation Models Available to DER

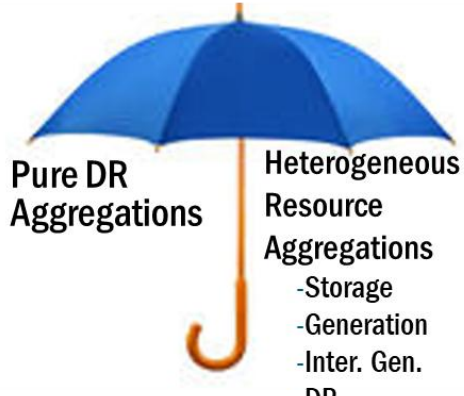
Non-Dispatchable DER

>=100kW

- Capacity
- Energy for reliability based events

- Energy for reliability based events

Dispatchable DER



>=100kW

- Capacity
- Energy

- Capacity
- Energy

>=1MW

- Capacity
- Energy
- Ancillary

- Capacity
- Energy
- Ancillary

In Front of the Meter

>=100kW

- Capacity
- Energy

>=1MW

- Capacity
- Energy
- Ancillary

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Aggregations

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Dispatchable DER Aggregations

- Dispatchable DER aggregators will be called DER Coordination Entities (DCE)
- A dispatchable DER aggregation will be called a DCE Aggregation (DCEA)
- DCEAs can comprise of DER that are all Demand Side Resources, or a mix of DER types
- All DER in a DCEA must be behind a single transmission node
- DCEA must be able to offer at least 100kW, offers above minimum in increments of 100kW
  - No maximum offer size

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Dispatchable DER Aggregations, con't

- Permitting all resources with a capability of 20 MW or less and located at multiple interconnection points to aggregate to a single transmission node is a departure from the NYISO's existing rules
- Tariff development for dispatchable DER aggregation rules will begin in 2018

DCEA Registration

- **DCE will be responsible for:**
  - Registering the DCEA with the NYISO
  - Meeting all DCEA obligations for participation in the wholesale markets
  - Meeting applicable utility registration, interconnection, and other obligations
- **The NYISO also expects the DCE to work with the utility to:**
  - Verify all resources are mapped to the transmission node prior to DCEA registration
  - Provide all local utility account numbers of individual DER in the DCEA to NYISO

DCEA Operations

- **DCE will be responsible for:**
  - Notifying the NYISO of all DCEA derates and outages (planned and forced) and distribution system issues (*i.e.*, distribution system outages)
  - DCE will be required to update Day-Ahead and Real-Time bids to reflect changes

DCEA Market Participation

DCEA Market Participation

- **DCEAs may qualify to provide:**
  - Energy
  - Capacity
  - Ancillary Services
    - Regulation Service
    - Reserves

DCEA Energy Market Participation

- All DCEAs meeting minimum operating requirements can provide Energy
- NYISO runs a Security Constrained Economic Dispatch (SCED) that co-optimizes Ancillary Services (Operating Reserves and Regulation) and Energy for each PTID
  - NYISO rules require SCED to run and solve its algorithms within specified time periods
  - As the number of PTIDs increases to much higher volumes, the increased processing time for NYISO's Security Constrained Economic Dispatch may unreasonably delay the solution
- To mitigate SCED delays:
  - Offers from DCEAs greater than/equal to 1 MW will be considered on a stand-alone basis
    - Unless DCEA chooses not to provide A/S, these DCEAs will have their offers combined with those less than 1 MW
  - Offers from DCEAs less than 1 MW will have their offers combined into a single PTID, with individual schedules disaggregated after scheduling
    - This concept will be used purely for optimization, this not something that a DCE will be able to elect
- The NYISO is exploring the feasibility of permitting DCEAs smaller than 1 MW to participate on a stand-alone basis

DCEA Ancillary Services Market Participation

- For the same reasons discussed previously regarding the mathematical complexity of co-optimizing energy and ancillary services only those DCEAs that are 1 MW or greater will be eligible to provide Ancillary Services
- The co-optimization uses each resource's individual and separate bid parameters for energy, reserves, and regulation, evaluates the lost opportunity costs for each service, and tries to find the optimal schedule for energy, reserves, and regulation for each resource. Because the parameters for each service of a resource is independently evaluated, these parameters cannot be combined without losing the ability to evaluate the lost opportunity costs for each service that is required for proper co-optimization evaluation.

DCEA Installed Capacity Market Participation

- **Qualified DCEAs will be eligible to participate in NYISO's Capacity Market**
  - NYISO continues to evaluate eligibility criteria for DCEAs
- **NYISO intends to assess the value of DER capacity beginning in 2018**
- **This assessment looks to:**
  - Define a "Capacity Window"
    - Time of day and duration where capacity value is highest
  - Utilize a capacity model similar to that for intermittent resources, with differences based on availability instead of output
  - Prorate DER capacity for resources that are unable to meet requirements for the full duration of the "capacity window"

Measurement & Verification, Monitoring & Control

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Measurement & Verification and Monitoring & Control: Overview

- **Measurement & Verification (M&V) refers to after-the-fact verification of performance for the purpose of financial settlements.**
  - NYISO engaged a consultant to undertake a study on M&V concepts for DER
  - Consultant's Report was released on December 9, and is available at: http://www.nyiso.com/public/webdocs/markets_operations/committees/bic_miwg/meeting_materials/2017-12-13/NYISO%20Meter%20Data%20Study%20Report.pdf
- **Monitoring & Control (M&C) refers to real-time situational awareness and operational control.**
  - NYISO has conducted an internal review of real-time telemetry for power system operations, including: communications options, communication protocols, scan rate, and latency
- **NYISO has worked with the Joint Utilities of New York on both M&C and M&V concepts to develop solutions that are consistent with wholesale and distribution needs.**

Meter Data Study – E-Cubed Policy Associates, LLC

- E-Cubed Policy Associates, LLC recently completed a study for the NYISO on specific DER Measurement & Verification (M&V) topics
- Objective of the study was to provide guidance on
  - Performance evaluation methodologies for DER aggregations
  - Provision of meter services for DER participating in the wholesale market
- The final report has been posted on the NYISO website
- The NYISO will review the Report's findings and recommendations and incorporate those findings as appropriate in the final market design

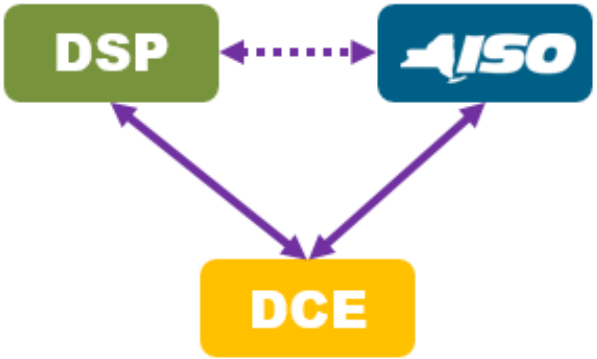
Real-Time Telemetry for Power System Operations: Communication Options

- Existing rules require Generators to send data through the appropriate TO to the NYISO
  - DSASP Resources have the option of direct communication with the NYISO as the primary communication path
- NYISO proposes two options for DER communication of telemetry data:
  - Existing communication path through the TO to the NYISO; and
  - Simultaneously to the NYISO and TO
- For both options, the utility must receive the same telemetered values as the NYISO for the purposes of maintaining interim control center operations

Options for Real-time Telemetry Data Communication Paths

Option 1 – DCE communicates only with DSP and DSP provides data to/from NYISO

Option 2 – DCE communicates with both DSP and NYISO in parallel



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Real-Time Telemetry for Power System Operations: Communication Protocols

- The NYISO currently requires resources to use Inter-control Center Communications Protocol (ICCP) to transmit telemetry data
- The NYISO has not received any feedback from its stakeholders on whether the NYISO should consider alternative communication protocols
  - NYISO currently does not plan to consider integration of an alternative communication protocol unless there is interest expressed by its stakeholders

Real-Time Telemetry Requirements for Power System Operations: Scan Rate

- **NYISO requires 6-second scan rate for telemetered data from all suppliers participating in NYISO's Energy and/or Ancillary Services Market † in order to:**
  - Maintain situational awareness of the power system, especially during significant unexpected events or changes occurring on the NYCA system
  - Maintain NYISO's ability to instruct resources to respond to significant unexpected events or changes that occur on the NYCA system to maintain system reliability
    - NYISO can dispatch any available resources, including energy-only resources, to respond to reliability events
  - Maintain optimization of its security-constrained economic dispatch (SCED) and co-optimization of energy and operating reserves
    - 6-second analog data (*i.e.,* MW output) from resources providing energy or ancillary services are inputs into SCED and impact Automatic Generation Control (AGC) basepoints including those to Regulation Suppliers
  - Meet reliability criteria including those that are unique to New York State
    - New York State Reliability Council's D.1 reliability requirement requires bulk transmission facility overloads above Short Term Emergency (STE) rating be relieved within 5 minutes

†DADRP Resources are not required to have telemetry

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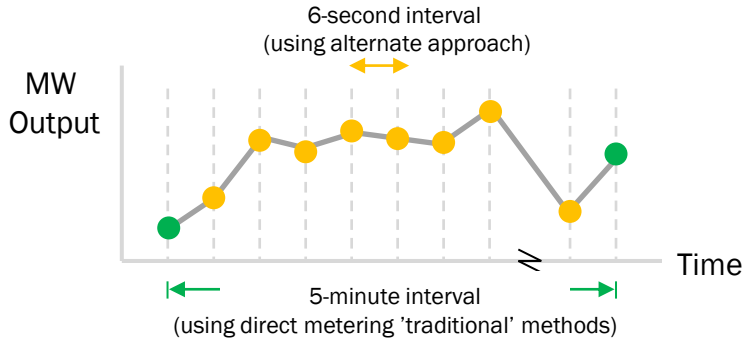
Real-Time Telemetry Requirements for Power System Operations: Scan Rate, con't

- **NYISO proposes to require 6-second scan rates for participants in the dispatachable DER participation model**
  - Dispatchable DER will have similar impacts on grid operations as that of other supply resources
  - Demand Side Resources participating as dispatchable DER will be seen as generation in real-time grid operations and therefore requires the same treatment and visibility as generation resources
  - Unit Desired Generation signal provided to the DCEA from the NYISO is the expected response for the aggregation as a whole within a specific 6-second time interval
  - Resource Gen MW/MVAR signal provided from the DCEA to the NYISO must reflect the MW/MVAR output from all resources that comprise the aggregation within a 6-second time interval

Real-Time Telemetry for Power System Operations: Alternate Telemetry Approach for Small Aggregated Resources

- **NYISO is considering an alternate approach for small resources (*e.g.,* residential resources) to provide real-time operational data for telemetry at a 6-second scan rate**
- **Purpose**
  - To reduce cost of telemetry for smaller resources through alternative methods, and
  - To maintain NYISO operational visibility to smaller resources on a 6-second basis



- **Expectation**
  - For each resource within an aggregation, the DCEA is expected to have MW/MVAR output data for that resource on a 6-second basis to generate its aggregate MW/MVAR output values for telemetry to the NYISO
  - Resource 6-second MW/MVAR output values comprise:
    - Measurements through direct metering ('traditional') methods (*e.g.,* CT/PT) from the resource with periodicity of 5 minutes or faster, and
    - Calculated values through an alternate approach to augment direct metered values as needed to produce operational data on a 6-second basis

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Real-Time Telemetry for Power System Operations: Alternate Telemetry Approach for Small Aggregated Resources, con't

- **Eligibility**
  - DER in a DCEA providing ancillary services would be ineligible to use this alternate telemetry approach
- **NYISO will evaluate approaches proposed by stakeholders on a case-by-case basis for**
  - precision (*i.e.,* consistency),
  - accuracy data integrity, and
  - replicability
- **NYISO will approve alternate approaches before use**

Performance Obligations

DCEA Performance Obligations: Overview

- **The NYISO intends to apply existing generator performance obligations to a DCEA**
  - Some obligations may need to be modified to account for DER capabilities

DCEA Eligibility and Bid Parameters

- DCEA eligibility will parallel traditional generators
- DCEA will use a combination of existing offer parameters similar to traditional generators and those in the Energy Storage Integration MDCP that are applicable
- Minimum bid requirement shall be reduced from 1MW to 100kW
- Where applicable, DCE will be able to use some of the ESR offer parameters currently being developed

DCEA Commitment & Dispatch

- **The NYISO has concerns about the impact a significant number of new resources would have on the NYISO's Security Constrained Unit Commitment (SCUC) and Real-Time Commitment (RTC) solution times**
  - NYISO is studying to what extent additional smaller resources can be included in SCUC and RTC without unreasonable solution times and potential impacts to the Unit Commitment algorithm solution tolerance
- **NYISO does not foresee any logic changes to the SCUC, RTC and RTD optimizations at this time**

DCEA Commitment & Dispatch, con't

- NYISO is trying to find a balance between allowing all resources to participate (including allowing DCEA commitment) and impacts on market efficiency and operational reliability
- The NYISO is currently exploring the possibility of allowing DCEAs 1MW and larger to be eligible for an alternate commitment mechanism that could provide advanced startup notification

FERC Order No. 745

- FERC Order No. 745 specified a set of rules related to the compensation of demand response resources participating in wholesale energy markets (the Day-Ahead Demand Response Program (DADRP), and energy component of DSASP offers) in New York
- Beginning with the planned deployment in 2018:
  - The Net Benefits Test – monthly determination of the threshold price point at which the benefits of deploying demand response outweighs the costs
    - NYISO uses the threshold price point as the offer floor for DADRP and DSASP resource energy bids
  - Measurement and Verification – NYISO uses an Economic Customer Baseline Load to measure DADRP resource's demand reductions
  - Cost Allocation – the costs of DADRP are allocated to all transmission customers on the basis of their load-ratio share

FERC Order No. 745, con't

- NYISO's current proposal is that all dispatchable DER aggregations will be classified as either net-injection or net-curtailment
- The NYISO proposes to apply the existing Net Benefits Test and Cost Allocation methodologies to all net-curtailment DCEAs

FERC Order No. 745, con't

- The Net Benefits Test and Cost Allocation methodologies for Order 745 ***will not*** be applied to net-injection DCEAs
- Application of these Order No. 745 rules will apply regardless of technology mix within a heterogeneous net-curtailment aggregation

Dual Participation

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Dual Participation

- The NYISO considers dual participation to be the simultaneous enrollment of an individual resource to provide service to the NYISO-administered wholesale markets and to another entity (*e.g.,* utility or host facility)
- At this time the NYISO intends to develop rules for dual participation for the dispatchable DER participation model only
- The NYISO is currently working with the Joint Utilities to determine how to coordinate Dual Participation
  - Dual participation will require significant coordination between utilities and NYISO across many business areas (operations, planning, registration, etc.)

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Dual Participation Outside of this MDCP

- The NYISO's focus in this MDCP is on creating a market design for Dual Participation of dispatchable DER
- The NYISO understands that there is interest in Dual Participation for other resources and intends to evaluate the feasibility of this in the future

Additional Initiatives

NYISO Pilot Program

- As part of DER Roadmap efforts, NYISO has established a Pilot Project Program to test and develop DER-related technology
  - Purpose is to demonstrate DCEA/DER capabilities, integration, coordination, and dual participation
- The Pilot Program will be administered through a test environment, not in the NYISO's production (*i.e.,* "live") market and operations system
- Pilot Program participants will not be compensated by the NYISO for participation in the DER Pilot Program
- NYISO has made available on its public website a Pilot Program Guide that includes the registration information, rules, selection criteria, and other forms that will be used in the administration of the Pilot Program

NYISO Pilot Program Objectives

1. Assess the capability of DER aggregations and other homogeneous aggregations of smaller resources to provide energy and ancillary services and the associated benefits to the wholesale markets
2. Develop and evaluate DER and DCEA measurement and verification (M&V) and monitoring and control (M&C) requirements
3. Establish and evaluate an operational coordination framework between NYISO, utilities, DCE, and DER
4. Establish and evaluate DER and DCEA registration processes

Anticipated Timeline for Pilot Projects

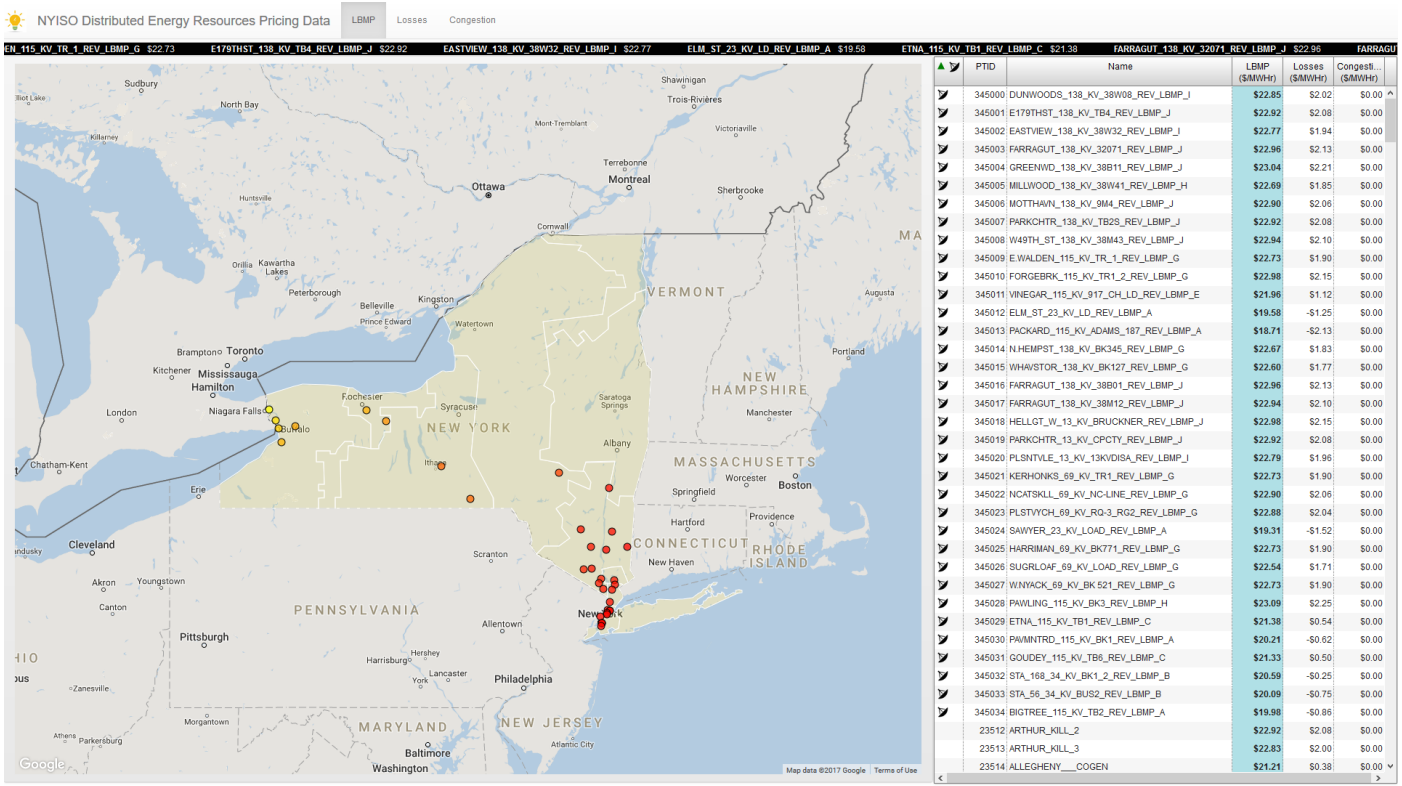
- The Pilot Program will start in May 2018, when the first Pilot Projects are anticipated to be announced, and end in April 2020

	Anticipated Dates
Business Issues Committee (BIC) Presentation	August 9, 2017
Present Final Draft Pilot Program Guide and Registration Materials to Market Issues Working Group (MIWG)	September 29, 2017
Publish Pilot Program Guide and Registration Materials and Enrollment Opens	October 20, 2017
Close Applicant Question Period	November 3, 2017
Close Pilot Program Enrollment	Extended to January 31, 2018
Finalists Notified	March 2018 (Targeted)
Pilots Accepted and Announced	May 2018 (Targeted)
NYISO Pilot Test Environment Ready to Begin Pilot Testing	June 2018

Granular Pricing Project

- **In 2016, the NYISO initiated a proof of concept to start publish intra-zonal Load bus (transmission node) prices for select locations**
  - Initial deployment currently publishes 35 nodes;
  - Information provided includes:
    - Node name & location
    - LBMP, Losses & Congestion ($/MWHr)
  - Initial pricing proof of concept map is currently “live” and available online
    - www.nyisopilotnodalprices.com

Proof of Concept Website



PTID	Name	LBMP ($/MWHr)	Losses ($/MWHr)	Congesti... ($/MWHr)
345000	DUNWOODS_138_KV_38W08_REV_LBMP_I	$22.85	$2.02	$0.00
345001	E179THST_138_KV_TB4_REV_LBMP_J	$22.92	$2.08	$0.00
345002	EASTVIEW_138_KV_38W32_REV_LBMP_I	$22.77	$1.94	$0.00
345003	FARRAGUT_138_KV_32071_REV_LBMP_J	$22.96	$2.13	$0.00
345004	GREENWD_138_KV_38B11_REV_LBMP_J	$23.04	$2.21	$0.00
345005	MILLWOOD_138_KV_38W41_REV_LBMP_H	$22.69	$1.85	$0.00
345006	MOTTHAVN_138_KV_9M4_REV_LBMP_J	$22.90	$2.06	$0.00
345007	PARKCHTR_138_KV_TB2S_REV_LBMP_J	$22.92	$2.08	$0.00
345008	W49TH_ST_138_KV_38M43_REV_LBMP_J	$22.94	$2.10	$0.00
345009	E.WALDEN_115_KV_TR_1_REV_LBMP_G	$22.73	$1.90	$0.00
345010	FORGEBRK_115_KV_TR1_2_REV_LBMP_G	$22.98	$2.15	$0.00
345011	VINEGAR_115_KV_917_CH_LD_REV_LBMP_E	$21.96	$1.12	$0.00
345012	ELM_ST_23_KV_LD_REV_LBMP_A	$19.58	-$1.25	$0.00
345013	PACKARD_115_KV_ADAMS_187_REV_LBMP_A	$18.71	-$2.13	$0.00
345014	N.HEMPST_138_KV_BK345_REV_LBMP_G	$22.67	$1.83	$0.00
345015	WHAVSTOR_138_KV_BK127_REV_LBMP_G	$22.60	$1.77	$0.00
345016	FARRAGUT_138_KV_38B01_REV_LBMP_J	$22.96	$2.13	$0.00
345017	FARRAGUT_138_KV_38M12_REV_LBMP_J	$22.94	$2.10	$0.00
345018	HELLGT_W_13_KV_BRUCKNER_REV_LBMP_J	$22.98	$2.15	$0.00
345019	PARKCHTR_13_KV_CPCTY_REV_LBMP_J	$22.92	$2.08	$0.00
345020	PLSNTVLE_13_KV_13KVDISA_REV_LBMP_I	$22.79	$1.96	$0.00
345021	KERHONKS_69_KV_TR1_REV_LBMP_G	$22.73	$1.90	$0.00
345022	NCATSKLL_69_KV_NC-LINE_REV_LBMP_G	$22.90	$2.06	$0.00
345023	PLSTVYCH_69_KV_RQ-3_RG2_REV_LBMP_G	$22.88	$2.04	$0.00
345024	SAWYER_23_KV_LOAD_REV_LBMP_A	$19.31	-$1.52	$0.00
345025	HARRIMAN_69_KV_BK771_REV_LBMP_G	$22.73	$1.90	$0.00
345026	SUGRLOAF_69_KV_LOAD_REV_LBMP_G	$22.54	$1.71	$0.00
345027	W.NYACK_69_KV_BK 521_REV_LBMP_G	$22.73	$1.90	$0.00
345028	PAWLING_115_KV_BK3_REV_LBMP_H	$23.09	$2.25	$0.00
345029	ETNA_115_KV_TB1_REV_LBMP_C	$21.38	$0.54	$0.00
345030	PAMNTRD_115_KV_BK1_REV_LBMP_A	$20.21	-$0.62	$0.00
345031	GOUDEY_115_KV_TB6_REV_LBMP_C	$21.33	$0.50	$0.00
345032	STA_168_34_KV_BK1_2_REV_LBMP_B	$20.59	-$0.25	$0.00
345033	STA_56_34_KV_BUS2_REV_LBMP_B	$20.09	-$0.75	$0.00
345034	BIGTREE_115_KV_TB2_REV_LBMP_A	$19.98	-$0.86	$0.00
23512	ARTHUR_KILL_2	$22.92	$2.08	$0.00
23513	ARTHUR_KILL_3	$22.83	$2.00	$0.00
23514	ALLEGHENY___COGEN	$21.21	$0.38	$0.00

Future Granular Pricing Project

- Prior to the implementation of the dispatchable DER participation model, the NYISO will work with the respective utility to identify the minimum number of transmission nodes to balance DER aggregation participation with the need to recognize intra-zonal electrical differences
- The NYISO intends for these additions to include:
  - Increased pricing nodes
    - Developed at the geographic intervals within a sub-zone, where price disparity occurs
    - Expectation is for an additional 100-200, State-wide
  - Increased interface options
    - Export file
    - Possible API for 3rd party data retrieval
  - Publishing of the following pricing data at 5 minute intervals:
    - Real-Time LBMP
    - Day Ahead LBMP
    - Ancillary Services

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Next Steps

- In 2018, the NYISO will develop rules for Capacity Market offer requirements, mitigation, forecasting and interconnection
  - The NYISO will also more fully develop the market rules and tariff language to implement this MDCP
- The NYISO will evaluate the implementation of rules through the pilot program
- NYISO plans to conclude development of rules in 2018 for the eventual implementation of DER in 2021

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Feedback?

- To ensure all feedback is captured please email additional feedback to: DER_Feedback@nyiso.com

Reminder – All comments received will be posted on the NYISO Distributed Energy Resources webpage

Appendix A - Acronyms

- DER – Distributed Energy Resource
- DCE – DER Coordinator Entity
- DCEA – DCE Aggregation
- DSP – Distributed System Platform
- DR – Demand Response
- RT - Real-Time
- DA – Day-Ahead
- RTC – RT Commitment
- RTD – RT Dispatch
- DAM – DA Market
- RTM – RT Market

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The Mission of the New York Independent System Operator, in collaboration with its stakeholders, is to serve the public interest and provide benefits to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policy makers, stakeholders and investors in the power system

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