NY Green Bank
Financial Market Transformation Study

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1. INTRODUCTION

1.1. NY Green Bank Description

NY Green Bank ("**NYGB**") is a $1.0 billion investment fund designed to accelerate clean energy deployment in New York State. Since its formation, NYGB has worked to increase the size, volume and breadth of clean energy investment in New York State (the "**State**" or "**NYS**"), expand the base of investors in clean energy deployment in the State and increase market participants' access to capital on commercial terms.

To achieve these objectives, NYGB collaborates with the private sector to develop transaction structures and methodologies that address barriers to clean energy investment. Through its work with counterparties (clean energy project developers, other firms delivering clean energy solutions, and financial institutions), NYGB has identified many financial market barriers that impede the flow of capital to potentially attractive opportunities. Among the most common are:

- Lack of transaction standardization;
- Insufficient scale and volume relative to the business objectives and practices of large investors; and
- Inadequate data on project sponsors and counterparty credits; underlying debt (or equity) investments; technology performance; and underdeveloped or nonexistent capital markets for clean energy projects.

To address these barriers, NYGB's investment strategy focuses on identifying and developing opportunities that create attractive precedents, standardized practices, and roadmaps that capital providers can readily replicate and scale. As funders "crowd in" to a particular area within the clean energy landscape, NYGB moves on to other areas that have received less investor interest.

NYGB follows certain important operating principles to increase private capital participation in clean energy markets:

- Focusing on wholesale capital markets (that is, providing structured financial products to developers and specific projects that result in clean energy benefits for all New Yorkers at scale – rather than funding consumers/homeowners directly);
- Structuring financial products to foster replicable investments;
- Pricing financial products consistently with commercial approaches to credit quality and risk, earning a return on investment to preserve and grow NYGB's capital base;

- Collaborating with, rather than competing against, market participants that: (i) can engage, or (ii) are already engaging the financial markets, but where that engagement or progress is constrained by a lack of available financing; and
- Recycling its capital into new clean energy projects when income is generated and as investments mature or are realized, maximizing the impact of its capital across multiple deployments.

NYGB initiated financing operations in 2014 and closed its first financing transactions in 2015. As of December 31, 2018, NYGB had closed $637.6 million in overall investments to support between $1.51 and $1.75 billion of total clean energy project deployment. In the process, NYGB has worked with 55 counterparties.

NYGB is a division of the New York State Energy Research and Development Authority ("NYSERDA"). NYSERDA commissioned this first independent NY Green Bank Financial Market Transformation Study (the "Study") of the effect that NYGB's activities have had on clean energy financing markets in NYS. This report (the "Report") summarizes the results of the first phase of the Study, which was conducted between September 2018 and February 2019. NYSERDA plans to conduct subsequent updates to measure change over time in NYGB's impact on these markets.

1.2. Summary of Study Objectives and Methods

Working with NYGB, NYSERDA staff developed a study approach designed to assess the influence of NYGB's early activities on the following characteristics of the clean energy finance markets in NYS:

1. Knowledge of and confidence in clean energy investments among financial institutions;
2. Number and type of financial institutions active in clean energy markets;
3. Availability of favorable terms in financing offered to clean energy projects and companies;
4. Pace of clean energy project deployment; and
5. Volume of clean energy project financing.

NYSERDA and NYGB developed a set of hypotheses on how NYGB's activities would affect these market characteristics over time. NYSERDA and NYGB also specified a set of market indicators (i.e., quantitative or qualitative measures of market conditions one would expect to observe if NYGB was influencing the market as hypothesized). The Study focused on gathering

and assessing the strength of evidence of changes in the NYS clean energy financing markets and NYGB's influence on those changes, using the hypotheses and market indicators as a framework.

DNV GL divided the Study into two complementary work streams.

Baseline Assessment. DNV GL appraised the state of the market during the period 2015 – 2018 ("the **Study Period**"), representing conditions before NYGB financing activity began in earnest and as it ramped up, using the set of market indicators specified by NYSERDA and NYGB as part of the Study plan. The baseline assessment ("**Baseline Assessment**") drew primarily on the results of surveys of developers and financiers conducted for the Study, supplemented by review of internal NYGB documents and an array of secondary sources. The Baseline Assessment was intended to provide a structured snapshot of market conditions that can be replicated in subsequent updates of the Study designed to gauge market progress over time.

Attribution Analysis. The attribution analysis ("**Attribution Analysis**") addressed the questions: How and to what extent did NYGB's activities contribute to changes observed in the clean energy finance market during the Study Period? The key challenge in answering these questions was to appropriately characterize and weigh factors *other than NYGB's activities* that shaped and influenced the business practices of participants in those markets. Many factors influenced the activities of clean energy project developers: changes in costs, energy prices, energy market regulation, tax, and general economic policy. Financiers were influenced by a similar set of factors, as well as by trends in the costs of capital, financial market regulation, and developments in industries and regions that offered alternate investment opportunities.

To capture these interactions, DNV GL prepared case studies of NYGB transactions involving counterparties in the residential solar, community solar, commercial/industrial solar, and commercial energy efficiency industries.[1] These case studies placed NYGB's transactions in the context of the markets they were designed to influence. This approach provided a framework to present evidence of change in the market indicators, to identify the potential influences on those changes, and to assess the relative importance of NYGB's activities among those influences. The case studies drew on the sources used for the Baseline Assessment, supplemented by analysis of market statistics, review of internal NYGB transaction documents, annual reports, Form 10-Ks

[1] In this study, the term "community solar" refers to solar PV projects in the category defined by the New York Public Service Commission's "Community Distributed Generation" designation. These are installations up to 10 MW in capacity that serve multiple end-use customers through various retail aggregation approaches. "Commercial/Industrial Solar" refers to solar PV projects in the same size category that serve a single end-use customer or "off-taker" under a long-term contract. In other states and in the energy industry press and literature, these two groups of projects are frequently grouped together under the rubric of "community solar".

filed with the Securities and Exchange Commission and other reports for public companies in NYGB's portfolios, and a wide range of industry, government, and academic publications.[2]

In the body of this report, the results of the Baseline Assessment and Attribution Analysis are integrated into an assessment of the strength of evidence of NYGB's influence on the indicators of market progress formulated by NYSERDA and NYGB.

1.3. Summary of Findings

NYGB has made a strong start in achieving its goals. Five years after its formation, and with $637.6 million in overall investments as of December 31, 2018, NYGB has become a more established investment and asset management platform. However, some of NYGB's investments are still in their early stages while the portfolio continues to mature. NYGB's transactions typically involve agreements among multiple parties and often require months to close. In sectors such as community and commercial/industrial solar, for example, the underlying projects typically take 18 – 24 months to plan and complete. The Study Period encompasses the earliest stages of NYGB's financing operations and the market response to those activities.

Given the timeframe of the Study Period and the range of other influences on clean energy finance markets, the DNV GL study team expected to find, at best, modest evidence of NYGB's influence. However, DNV GL identified credible evidence of NYGB's influence on many of the market indicators. The following summarizes the Study's major findings.

The success of the Mosaic transaction demonstrates the efficacy of NYGB's strategy**.** DNV GL's case study of NYGB's investment in Mosaic, Inc., a specialty financing company focused on the residential solar market, found that the transaction influenced investor knowledge and confidence in aggregation of consumer loans for solar PV systems, attracted new investors to the field, increased the volume of investment in a range of aggregation approaches to financing residential solar PV, and resulted in improved financing terms for Mosaic. The following box summarizes NYGB's investment in a warehouse credit facility for Mosaic.[3] In 2014, Mosaic launched a novel business model that greatly reduced the high customer acquisition and financing costs that had begun to inhibit growth in the solar PV industry. By mid-2015, Mosaic needed larger sources of capital from which it could make thousands of loans to homeowners through a nationwide network of participating dealers. The credit risk of the portfolio was unknown because the performance history of the underlying loans was unknown. In early 2016, after extensive due

[2] See Appendix I for a full list of sources.

[3] Warehouse credit facilities are a line of credit given to a loan originator, such as Mosaic, to fund loans for specific purposes, such as the purchase of a solar PV system. The life of the loan generally extends from its origination to the time it is sold into a secondary market, either directly or through securitization.

diligence and credit underwriting activities to assess the viability of Mosaic's approach, NYGB joined one other bank and committed $50 million in two stages to a warehouse credit facility to support Mosaic's national operations.

Mosaic used the credit and operating experience gained with the warehouse credit facility to support the development of a credit-rated securitization, which was immediately oversubscribed.[4] Based on successful execution of the business model and the rated securitization, two other lenders entered the facility and increased its overall size to $270 million. Mosaic issued four additional securitizations over the next 20 months with progressively more favorable borrowing terms, raising over $1.1 billion from more than 30 banks and investor groups. After only four years in the market, the Mosaic Solar Loan program commanded 14% (based on installed capacity) of the national market for residential solar project financing.[5]

WAREHOUSE CREDIT FACILITY CASE STUDY

2015: NYGB participates with one other bank in first, major unrated credit warehouse to support innovative residential solar loan product: $50 million for NY State projects.

2017: Mosaic uses the initial credit facility to demonstrate success of its business model and achieve an A rated term securitization. This transaction was oversubscribed by institutional investors, refinancing the warehouse to be used for further project loan aggregation.

2017 – 2019: Financial institutions respond favorably to subsequent opportunities. Mosaic issues five rated securitizations in 2017 – 2019 totaling over $1.1 billion to support lending volumes of $40 - $50 million/month.

Over 30 financial institutions participate in Mosaic securitized financings.

In 2018, Mosaic assumes national lead in volume of residential solar installations financed, with a 14% market share.

DNV GL identified changes in many of the evaluated market indicators that were directionally consistent with hypotheses concerning the market effects of NYGB activities. DNV GL also found evidence of NYGB influence on most of these observed changes. However, the evidence was generally not significant enough to support a definitive judgment of a causal relationship between NYGB activities and the market changes observed. As discussed earlier, DNV GL anticipated this pattern in the findings given that the Study Period covers only the earliest stages of NYGB operation.

[4] That is, the lead financier received more requests for participation than could be accommodated.
[5] John Weaver, "Cash is king in residential solar, long live the lease", PV Magazine, November 14, 2018, https://pv-magazine-usa.com/2018/11/14/cash-is-king-in-residential-solar-long-live-the-lease/.

The Study found evidence of NYGB's impact on the following market changes:

- Increase in the number of and average size of project financings and their total dollar volume in markets NYGB entered, particularly in residential and community solar;
- Increase in the number and type of financial institutions active in the clean energy finance markets; and
- In the residential solar financing market, the Study team found evidence of decreases in costs of capital for transactions that fund loans or leases to customers, the growth of secondary markets, and replication in the structure of transactions in which NYGB played an early role.

Most of the clear evidence on NYBG influence came from the Mosaic case study. NYGB's key role in financing Mosaic's first major credit facility, the importance of the operating information generated by that facility in supporting access to lower-cost securitized financing, the company's rapid growth *within the three-year Study Period,* and the small number of significant competitors in the market support a strong case for NYGB's impact.

It is too early to infer a strong influence of NYGB's activities and the transformation of other markets in which it operates, such as community solar, commercial/industrial solar, and commercial sector energy efficiency. Exogenous factors such as government regulation and industry fragmentation across both developers and financiers, coupled with limited data on market activity, made it difficult for the Baseline Assessment and Attribution Analysis to isolate the impact of NYGB. In other cases, the scale of business activity by NYGB's counterparties remained too small during the Study Period to support a plausible argument related to effects on the broader market. It is expected that future studies will identify further evidence of market change and of NYGB influence as the NYGB portfolio matures and continues to grow.

DNV GL identified little consistent evidence of NYGB's influence on one of the key market indicators: financial institution knowledge and confidence in clean energy investments. This indicator was originally anticipated to show change over a short (1-3 year) time frame. In several cases, NYGB's counterparties were first movers willing to make new kinds of investments or take new approaches to the deployment of clean energy assets. Thus, NYGB's investments generated new operating and credit experience that could serve as a guide to structuring similar future transactions. However, the volume of such experience remains too small for NYGB to aggregate across transaction types and disseminate anonymized data to the market more broadly. Hence, it is too early to detect a strong observable effect of NYGB's activities on financier and

developer knowledge and confidence in clean energy investments. Future impact studies may detect a stronger influence of NYGB on this market indicator.

2. MARKET CHARACTERIZATION AND ASSESSMENT RESULTS

2.1. Study Methods

2.1.1. Overview of Market Transformation Concepts and Assessment Approach

For the NYGB Financial Market Transformation Study, DNV GL used an approach that social scientists and evaluators have applied over the past several decades to assess the market effects of individual programs and market interventions.[6] The approach comprised the following steps:

1. Develop program logic models. Logic models posit a hypothetical causal chain between a program's activities and the responses of targeted market actors, using observations from staff, market actors, and others with direct experience of the program to map the chain. Logic models provide guidance on the types of data that should be collected and analysed to assess the influence of the program on the markets it is designed to affect. NYSERDA worked with NYGB staff to develop logic models to describe how NYGB's activities would affect clean energy finance markets in NYS. These models also specified the time frames in which NYSERDA and NYGB expected the developments to occur.

2. Derive indicators from the logic models. Specify indicators (and the expected time frames for their appearance) that derive from the logic model and should be observable if the hypothesized effects occur.

3. Develop data to measure the indicators. Collect quantitative data and qualitative information on the specified indicators from various sources, including stakeholder interviews, program data, and secondary sources.

4. Assess the strength of support for hypotheses in the logic model. In this Study, DNV GL divided the assessment of the strength of each indicator into the following three components.

    - Current Condition/Direction of Change. This component assessed available evidence to determine whether observed market conditions during the Study Period or changes in those conditions corresponded to the relevant hypotheses in the logic model.

    - NYGB Influence. The second component assessed the strength of evidence that NYGB – as opposed to other exogenous forces –influenced the observed changes in a market indicator. Such evidence comes from interviews of market actors,

[6] These methods have been reviewed and adopted by the State of New York Public Service Commission. See Metrics, Tracking, and Performance Assessment Working Group, 2018. *Market Transformation Metrics.*

examination of the sequence of events to establish precedence, comparison of market activity in states without a special purpose green bank to activity in NYS, and assessment of the relative importance of other potential influences on the market indicator.

- Robustness Assessment. This component assessed the quantity and quality of the data used to validate the hypothesis. For example, information from annual surveys with well-documented samples and methods were weighted more heavily than occasional research efforts that report the opinions of a few market actors.

The adjacent box provides an example of the application of this assessment approach.

EXAMPLE OF INDICATOR SCORING

Increase in the number of financiers offering financial products similar to those offered by NYGB

Current Conditions/Direction of Change

- **Survey respondents report increase in number of financial institutions in clean energy markets**
- **Number of investors participating in Mosaic transactions increases from 2 to 29 from 2016 – 2018**
- **Number of investors in community and commercial/industrial projects in NYS increases from 2017 – 2018.**

SCORE: INTERMEDIATE

NYGB Influence

- **NYGB participated in first securitization of solar loans - 2016. Many other financial firms followed.**
- **NYGB was an early investor in community and commercial/industrial solar, but many other financiers were in the market.**

SCORE: INTERMEDIATE

Robustness Assessment: evidence available from the following sources:

- **Market actor surveys**
- **Industry Press**
- **Government & industry project databases**

SCORE: INTERMEDIATE

NYSERDA and NYGB staff developed logic models of how each of NYGB's major financial products would affect clean energy project developers and financial services firms.[7] From those models, NYSERDA and NYGB derived 15 market indicators and identified the time frames in which they expected that changes in the indicators might be observed: short-term (1 – 3 years); mid-term (3 – 5 years); and long-term (5+ years). With NYGB closing its first transactions in late 2015, this Report covers the "short-term" period. Figure 1 displays a timeline of NYGB activities which were the focus of the Study. The vertical markers beginning in 2015 represent a subset of individual NYGB transactions that were covered by the Study, with the case study subjects called out.

Figure 1. Timeline of NYGB Activities

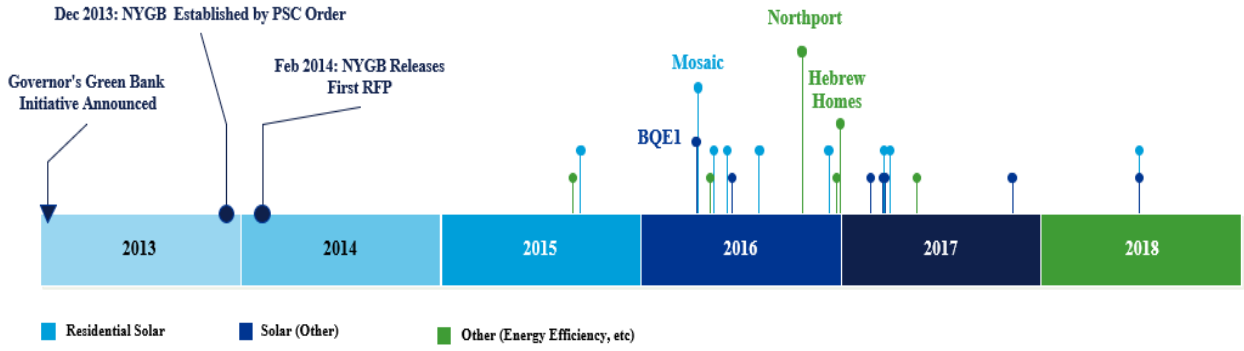


Table 1 lists the market indicators, the associated time frames assigned by NYSERDA and NYGB, the definitions used to formulate survey questions and assess information from secondary sources, and the sources of information used to assign values to the indicators. Some indicators show two timeframes because NYSERDA and NYGB assigned different timeframes for each financial product NYGB offered during the Study Period. DNV GL assessed thirteen of these indicators.

[7] These financial products were as follows: Asset Loan & Investment – Term Loans, Bridge Loans, Subordinated Capital, Refinance. Construction Finance and Term Loans, Revolver – Construction Finance, Warehousing Aggregation

Table 1. Market Indicator Definitions, Time Frames and Data Sources

Indicator	Definition	Timeframe*	Financiers Interviews / Surveys	Developers Interviews / Surveys	Press	Industry Sources	Government Reports & Statistics
Availability of informative data on clean energy project financial performance	Availability of validated information on the financial performance of actual clean energy projects: e.g. rating agency pre-sale documents.	**Short**	●		○	○	
Availability of informative data on clean energy project technical performance	Availability of validated data on the field performance of clean energy technologies: e.g. M&V reports and cost-benefit analyses.	**Short**				○	●
Increased awareness in financial community of clean energy investment opportunities	Increase over time in the proportion of financiers who report being aware of clean energy investment opportunities.	**Short / Medium**	●	●		●	
Increase in clean energy transactions with risk/return profiles acceptable to financiers	Increase over time in the number of clean energy projects or businesses that meet financiers' criteria for funding.	**Medium**	●	○	●	●	
Increase in the scale of individual clean energy project financing transactions	Increase over time in the average size or characteristic range of sizes for clean energy projects or financial transactions of a given type.	**Medium**	○	●	●	●	○
Increase in number of clean energy project financings	Increase over time in the number of clean energy project financings of a given type.	**Medium / Long**	●	○	●	●	○
Increase in the number of financiers offering products supported by NYGB	Increase over time in the number and type of financiers offering financial products similar to those offered by NYGB.	**Medium / Long**	●	●	●	●	○
Increase in the number of third-party owners	Increase in the number of financiers participating as third-party asset owners through leases or Power Purchase Agreements (PPAs). **Not assessed; deleted from study plan.**	**Medium / Long**	●	○	●	●	●
Replication by developers of NYGB financing approaches – Residential/Commercial	Reports of financing approaches that are the same or similar to those used by NYGB.	**Medium / Long**	○	○	●	●	○
Increase in the total volume of clean energy project financings	Increase over time in number of clean energy project financings of a given type	**Long**	○	○	●	●	○
Increase in the volume of clean energy projects	Increase in the number, capacity or dollar volume of clean energy projects of a given type in a given market	**Long**	●	○	●	●	●
Emergence of secondary markets	Increase in the volume over time of sales of loan or lease receivables to secondary markets, either directly or through securitization.	**Long**	●	○	●	●	●
Reduction in financing costs: interest rate, transaction costs, equity requirements, etc.	Reduction over time in financing costs, primarily interest rates and equity requirements (advance rates).	**Long**	●	●	○	●	○
Reduced elapsed time to complete transactions	Reduction in time interval between application for financing and transaction closing.	**Long**	●	●			
Reduction in clean energy technology costs	Reduction over time in the unit installed cost of a given market. **Not assessed in this phase.**	**Long**	○	○	○	●	●

○ = Sources Used; ● = Productive Sources Used

* Short = 0-3 years from start of operations; Medium = 3-5 years from start of operation; Long >5 years from start of operation

In consultation with NYSERDA, DNV GL excluded the following two indicators in the study:

- Reduction in clean technology costs. DNV GL and NYSERDA agreed that it was very unlikely that NYGB activity would result in reductions in clean technology costs during the short time-frame of the Study Period. This indicator will be addressed in subsequent rounds of the Study.

- Increase in the number of third-party owners. In clean energy finance markets, third-party ownership refers to transactions in which the long-term owner of a project is neither the party that benefits directly from it (e.g. the owner of a facility that installs energy efficiency retrofits or a solar PV system), nor the party that developed it. Third-party transactions that are common in clean energy projects include equipment leases and power purchase agreements, in which investors independent of the project developer are assigned ownership of the project assets. That ownership status enables investors to claim various tax credits and deductions, as well as a share of project cash flows.

  The use of third-party approaches for a given set of transactions depends on many factors: the nature of the asset and the financial needs and interests of the site owners, project developers, and investors. In some situations, such as Mosaic's development of residential solar loans, significant segments of developers (solar PV system dealers) and site-owners (homeowners) find that their interests are better served if the customer retains ownership of the physical asset. Thus, the share of residential solar systems owned by third-party owners has declined in recent years, but the volume of installations and the variety of project financing options available to homeowners and dealers have increased.

  Based on these considerations, DNV GL and NYSERDA agreed that increase in the number of third-party owners was not an appropriate indicator for assessing NYGB's market effects. Moreover, DNV GL believes that the underlying objective of increasing the number and variety of investors active in clean energy projects is more explicitly captured in other indicators, such as "Emergence of secondary markets." and "Increase in the number of financiers offering products supported by NYGB." For these reasons, DNV GL did not include analysis of the increase in third-party owners in this Report.

2.1.2. Research and Analysis Activities

DNV GL carried out the following research and analysis activities in support of the Study.

Market Actor Surveys. DNV GL developed and implemented surveys of clean energy project financiers and developers to assess the current state of the clean energy finance market and stakeholders' perceptions of NYGB. The Study team attempted to contact representatives of all counterparties that had participated in NYGB transactions ("**Participants**"), either as borrowers or financing partners. The team also attempted to interview representatives of clean energy firms and financiers active in NYS that had not participated in NYGB transactions ("**Non-Participants**"). The Study team built sample lists for the Non-Participants from databases supplied by InfoUSA, as well as from lists of engineering due diligence customers in the renewable energy industry served by other divisions of DNV GL.[8] Table 2 displays the number of entities in the sample lists, the targeted number of completed surveys, and the number of surveys actually completed.

Table 2: Population Counts, Targeted Sample Sizes, and Number of Completed Market Actor Surveys by Market Actor Group[9]

	Participants		Non-Participants	
	Developers	Financial Institutions	Developers	Financial Institutions
Population Count (Sample Frame)	23	22	551	1,240
Target for Completed Surveys (Sample Size)	9	18	67	67
Surveys Completed	6	6	56	46
Response Rate	26%	27%	10%	4%
Target %	67%	33%	84%	67%

Despite the use of multiple survey delivery modes (web and phone) and multiple contacts, DNV GL completed surveys with only 12 Participants: six financiers and six developers. The number of completed surveys also fell somewhat below the target of 67 for Non-Participant developers

[8] DNV GL has a business unit that provides engineering due diligence services to investors in the renewable technology market.

[9] Response rate = the number of respondents who completed the survey/population count (sample list). Target percentage = the number of respondents who completed the survey/target for completed surveys (sample size)

and financial institutions. Moreover, many respondents elected not to answer all questions on the survey. Thus, for some indicators, DNV GL collected too few responses to draw meaningful conclusions. The low response rate may have been related to the project schedule, survey design, increasing survey fatigue in the marketplace, and other factors.

Where relevant, the sections below discuss the limitations in applying the survey data.

NYGB Documents. NYGB publishes information about its strategy, activities, performance, and impact.[10] Materials available on its website include: regulatory authorization and planning documents, annual business plans, annual and quarterly operating and financial metrics reports, annual audited financial statements, and detailed profiles for each closed transaction.

Secondary Research. The Study team reviewed a wide range of secondary resources to support the Study's findings. These materials were particularly useful in providing background and context for development of the case studies. Table 3 summarizes the type and number of sources used in this Report. Many more sources were reviewed for background; a full listing can be found in Appendix I.

Table 3. Secondary Sources Used in the Market Transformation Study

Type of Secondary Source and Examples	Number Used in Report
Industry Reports: reports by industry associations such as the Solar Energy Industry Association & American Wind Energy Association	9
Industry Databases: Databases of projects and technologies maintained by industry associations, such as SEIA's state-level solar project data	3
Government Reports: Reports from state and local governments on clean energy technology and markets: e.g. NREL series	9
Government Databases: Federal and NY State databases of clean energy projects, energy prices, technology price and performance	4
Corporate Materials: Information from individual companies, including Securities and Exchange Commission filings, annual reports	13
Press Reports: General and specialized industry press reports, mostly accessed on-line	7
Academic and Professional Literature. Reports and conference papers from private research institutes, advocacy organizations, corporations	6

[10] All materials mentioned are available at https://greenbank.ny.gov/.

2.1.3. Approach to Indicator Scoring

As is typical of market transformation evaluation, DNV GL drew from a wide variety of sources to characterize current market conditions and NYGB's influence on those conditions. Analyses of project databases and survey results provided quantitative support for the Report's conclusions. Other sources provided qualitative support. As expected, few sources covered exactly the same time period and geography. Therefore, the Study team developed a scoring system for the indicators to account for the disparate nature of data contained in some sources, while providing consistency across indicators and comparability across time. The following describes the scoring system applied to the market indicators.

Current Conditions/Direction of Change. This score captures DNV GL's assessment of the strength of evidence that market conditions or changes in market conditions observed during the Study Period correspond to conditions posited by the logic models. For example, if the logic model hypothesized that financiers working in a given market segment would seek to replicate a successful project financing approach demonstrated by NYGB or its counterparties, research should identify an increase in the number or percent of projects using that approach over time.

NYGB Influence. This score captures DNV GL's assessment of the strength of evidence that NYGB influenced the observed changes in a market indicator. Such evidence comes from interviews of market actors, examination of the sequence of events to establish precedence, comparison of market activity in states without a special purpose green bank to activity in NYS, and assessment of the relative importance of other potential influences on financing volume.

Table 4 summarizes the detailed criteria used to score the strength of the market indicators.

Table 4: Market Indicator Scoring Rubric

Rating	Criteria
Strong	Current Conditions/Change. Consistent evidence from multiple sources that conditions for clean energy finance were strong or changed as hypothesized in the program logic model and definition of the indicator (see Table 1). NYGB Influence. Consistent evidence from three or more sources of NYGB influence on observed changes in clean energy markets. This included strength of support for a plausible causal narrative of NYGB influence on observed changes.
Inter-mediate	Current Conditions/Change. Evidence of favorable conditions or change in hypothesized direction was mixed, but a majority support the hypothesis. NYGB Influence. Evidence of NYGB influence was available from at least two credible sources.
Minimal	Current Conditions/Change. Evidence of favorable conditions or change in hypothesized direction is mixed, but majority *does not support* the hypothesis. NYGB Influence. Evidence of NYGB influence was supported by one credible source.
Needs Further Research	Current Conditions/Change. Too few credible sources identified to support scoring. NYGB Influence. No sources available to validate or contradict assertion of NYGB influence.

Robustness Designations. DNV GL assigned a "robustness" rating to capture the quality of data supporting the strength of evidence rating.

Table 5: Robustness of Evidence Scoring Rubric

Rating	Criteria
Strong	All key data sources meet stringent quality standards. Such sources include: • Databases maintained over time by one organization using consistent data collection and quality control processes; • Peer reviewed government or professional reports; • Reports from reputable journals or longstanding on-line publications; • Corporate regulatory filings; • Regulatory documents; and • Interviews conducted by the DNV GL Study team.
Intermediate	The majority of sources meet stringent quality standards as described above, for Strong.
Minimal	Few sources meeting stringent quality standards as described above were available.

2.2. Summary of Market Transformation Findings

Table 6 presents the Study team's scoring of the market indicators on strength and robustness. Section 2.3 presents detailed findings that support these ratings.

Table 6. Summary of Findings on Market Indicators

Indicator	Timeframe*	Evidence of Changes as Hypothesized by Logic Model	Evidence of NYGB Influence	Robustness of Evidence
Availability of informative data on clean energy project financial performance	**Short**	Minimal	Minimal	Intermediate
Availability of informative data on clean energy project technical performance	**Short**	Minimal	Minimal	Intermediate
Increased awareness in financial community of clean energy investment opportunities	**Short / Medium**	Intermediate	Minimal	Minimal
Increase in clean energy transactions with risk/return profiles acceptable to financiers	**Medium**	Intermediate	Intermediate	Strong
Increase in the scale of individual clean energy project financing transactions	**Medium**	Strong	Strong	Strong
Increase in number of clean energy project financings	**Medium / Long**	Intermediate	Intermediate	Intermediate
Increase in the number of financiers offering products supported by NYGB	**Medium / Long**	Intermediate	Intermediate	Intermediate
Replication by developers of NYGB financing approaches – Residential/Commercial	**Medium / Long**	Intermediate (Resi) Minimal (Com)	Intermediate (Resi) Minimal (Com)	Intermediate (Resi) Minimal (Com)
Increase in the Total Volume of Clean Energy Project Financings	**Long**	Intermediate	Intermediate	Intermediate
Increase in the volume of Clean Energy Projects	**Long**	Intermediate	Intermediate (Resi) Minimal (Com)	Strong (Resi) Intermediate (Com)
Emergence of secondary markets	**Long**	Intermediate	Intermediate	Intermediate
Reduction in financing costs: interest rate, transaction costs, equity requirements, etc.	**Long**	Intermediate	Intermediate	Intermediate
Reduced elapsed time to complete transactions	**Long**	Intermediate	Minimal	Intermediate
Reduction in clean energy technology costs	**Long**	*Not Researched**		

* Short = 0-3 years from start of operations; Medium = 3-5 years from start of operation; Long >5 years from start of operation

2.3. Detailed Market Indicator Findings

This section describes the rationale for and presents supporting evidence behind each market indicator's strength and robustness rating as shown in Table 6.

2.3.1. Availability of Informative Data on Clean Energy Project Financial Performance (Short-Term Market Indicator)

Definition: Availability of validated information on the financial performance of completed clean energy projects: e.g., through rating agency pre-sale reports outlining deal structure and terms.

Table 7. Market Indicator Assessment: Availability of Informative Data on Clean Energy Project Financial Performance

Evidence of Change as Hypothesized by Logic Model	**S**	**I**	**M**
Evidence of NYGB Influence	**S**	**I**	**M**

S = Strong I = Intermediate M = Minimal

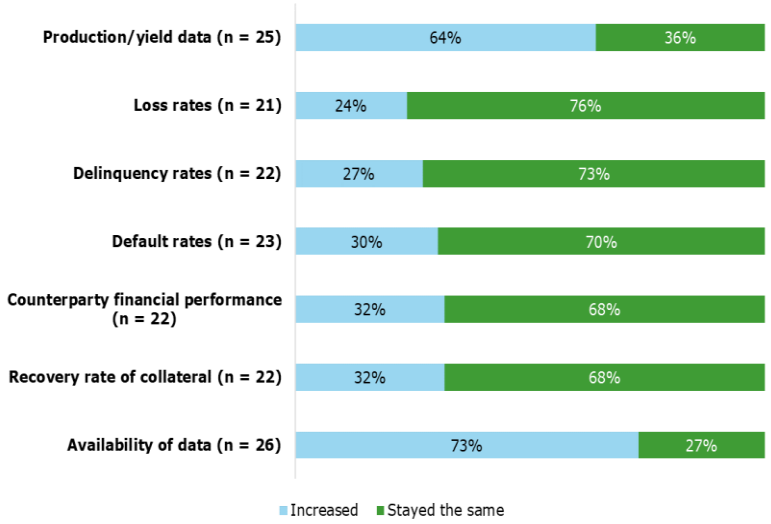
Evidence of Current Condition/Direction of Change.

- Both Participants and Non-Participants who responded to the surveys conducted for the Study reported that the availability of industry-level financial data was a less significant barrier to investing in clean energy projects in 2018 than it had been in the first year they started investing in or developing such projects. Of the respondents who reported an increase of the availability of broad-level financial data, 70% had been active in the clean energy market prior to 2014.

- Roughly one-quarter of Non-Participant financial respondents also indicated that various types of financial performance data were more available over the same time frame. Over 60% of respondents who were active in the clean energy market prior to 2013 reported an increase in the availability of production/yield data (Figure 2). [11]

[11] Production/yield data refers to the electricity production (kWh) from a renewable resource such as solar or wind units.

Figure 2. Change in Availability of Financial Performance Data Since First Year of Investing in Clean Energy, Non-Participant Financial Respondents



- DNV GL conducted in-depth case study interviews with four developers who observed an increase in the availability of market-level financial data but no material change in the amount of publicly available project-level data between 2015 and 2018.

Evidence of NYGB Influence.

- Project level financial performance data has historically been confidential and not publicly disclosed. In order to carry out its investment activities, NYGB observes standard commercial practices regarding disclosure of financial information about its counterparties. However, as NYGB closes and completes more transactions, it may be able to aggregate, anonymize, and disclose some data that will be helpful to developers and investors in structuring projects and financial transactions.

Robustness Assessment.

Direction • Participant and Non-Participant Finance and Developer Surveys • Mosaic, BQ Energy ("**BQE**") and Bank of America Merrill Lynch ("**BofA Merrill**") Case Study Interviews Influence • Participant and Non-Participant Surveys • Mosaic, BQE and BofA Merrill Case Study Interviews	**Intermediate**

2.3.2. Availability of Informative Data on Clean Energy Project Technical Performance (Short-Term Market Indicator)

Definition: Availability of validated data on the field performance of clean energy technologies: e.g. M&V reports and cost-benefit analyses.

Table 8. Market Indicator Assessment: Availability of Informative Data on Clean Energy Project Technical Performance

Evidence of Change as Hypothesized by Logic Model	S	I	M
Evidence of NYGB Influence	S	I	M

S = Strong I = Intermediate M = Minimal

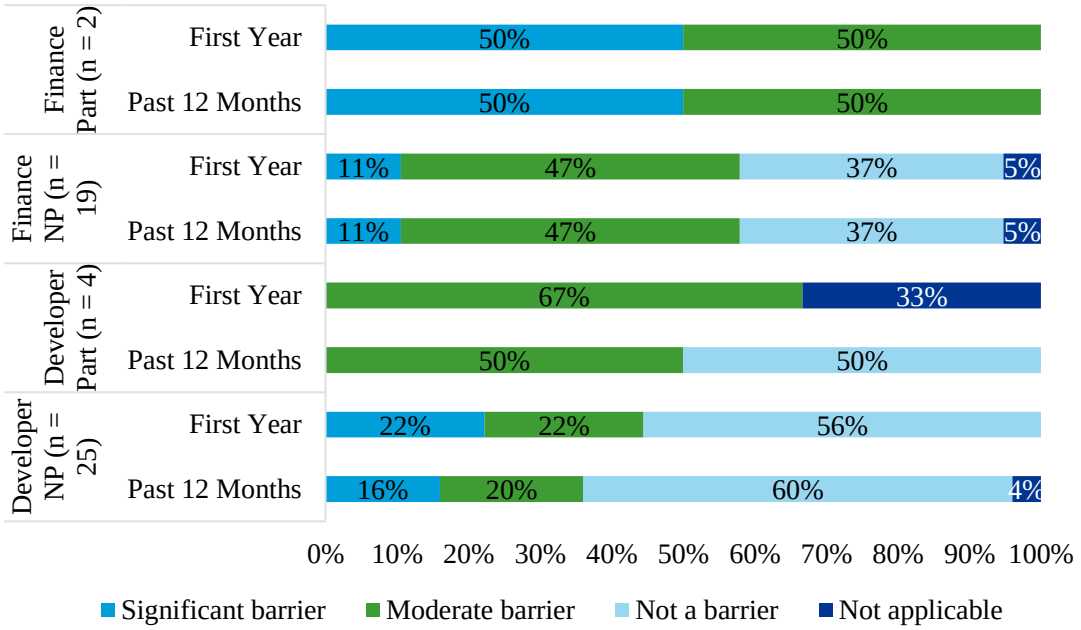
Evidence of Current Condition/Direction of Change.

- More than half of all financiers surveyed – Participants and Non-Participants –identified lack of informative data on the performance of clean energy technologies as a barrier to investment in 2018. The same percentage of respondents identified lack of any or sufficiently credible data as a barrier to investment when they first started investing in clean energy projects.

- Approximately 38% of developers – Participants and Non-Participants – reported that their ability to obtain financing within the past 12 months was negatively impacted by a lack of any or sufficient credible data to help financiers evaluate the performance of clean energy technologies. Over half identified this barrier when referring to the time of their earliest attempts to secure clean energy technology financing.

The difference between periods in the fraction of market actors who reported difficulties in obtaining data on clean energy technologies was too small to support conclusions regarding actual changes in the market.

Figure 3. Availability of Technology Performance Data as a Market Barrier, First Year Investing and 2018[12]



Evidence of NYGB Influence.

- NYSERDA has a comparatively longer track record of implementing and evaluating its clean energy programs and has published technology performance data amassed over the years on platforms such as Open NY[13] and other publicly-accessible channels. In fact, anonymized data on solar PV projects that are part of NYSERDA's NY-Sun program includes some projects also supported by the NYGB portfolio. However, survey respondents' awareness (both Participants and Non-Participants) of this data was limited.

Robustness Assessment.

Direction • Participant and Non-Participant Finance Surveys • Participant and Non-Participant Developer Surveys • Open NY: https://www.ny.gov/programs/open-ny Influence • Open NY: https://www.ny.gov/programs/open-ny	**Intermediate**

[12] For all figures and tables, NP denotes non-participant and Part refers to participant.
[13] Open NY: https://www.ny.gov/programs/open-ny.

2.3.3. Increased Awareness in Financial Community of Clean Energy Investment Opportunities (Short/Mid-Term Market Indicator)

Definition: Increase over time in the proportion of financiers who report being aware of clean energy investment opportunities.

Table 9. Market Indicator Assessment: Increased Awareness in the Financial Community of Clean Energy Investment Opportunities

Evidence of Change as Hypothesized by Logic Model	S	I	M
Evidence of NYGB Influence	S	I	M

S = Strong I = Intermediate M = Minimal

Evidence of Current Condition/Direction of Change.

- Surveys of Participant developers provided inconclusive results. Developer respondents were asked whether they believed NYGB had influenced a change in the financial community's awareness of the economic benefits of investing in clean energy projects. Two of four developers responded that NYGB was "very influential" and the remaining two responded that NYGB had "some influence" or "no influence."
- The number and variety of financial institutions active in the residential and community solar industries grew steadily over the Study period, indicating an increase in firms' awareness and participation in the clean energy market. See Section 2.3.7 for further analysis.

Evidence of NYGB Influence.

- NYSERDA and NYGB hypothesized that, over the short/mid-term, the financial community would become increasingly aware of clean energy investment opportunities. While this indicator is moving in the hypothesized direction, DNV GL identified insufficient evidence that the trend was related to NYGB activity during the Study Period.

Robustness Assessment.

Direction • Participant Developer Surveys Influence • Participant Developer Surveys	**Minimal**

2.3.4. Increase in Clean Energy Transactions with Risk/Return Profiles Acceptable to Financiers (Mid-Term Market Indicator)

Definition: Increase over time in the number of clean energy projects or businesses that meet financiers' criteria for funding.

Table 10. Market Indicator Assessment: Increase in Clean Energy Transactions with Risk/Return Profiles Acceptable to Financiers

Evidence of Change as Hypothesized by Logic Model	**S**	**I**	**M**
Evidence of NYGB Influence	**S**	**I**	**M**

S = Strong I = Intermediate M = Minimal

Evidence of Current Condition/Direction of Change.

- Evidence from the market actor surveys. A large share (41-50%) of both developer and financial respondents stated that the number of clean energy transactions acceptable to investors increased during the Study Period and noted improved return on investment as a major reason. Approximately 50% of all respondents identified increased access to long-term debt in smaller amounts as a driver of these trends.

- Evidence from the Mosaic Case Study. Mosaic's Director of Capital Markets attributed the company's ability to attract additional investors in later transactions to NYGB's involvement in Mosaic's early warehouse credit facility.

- Evidence from the BQE Case Study. The BQE case study supports the hypothesis that the number of projects meeting lender criteria increased during the Study Period. Specifically:

    - In its fourth and fifth project financings, BQE was able to attract the participation of a commercial bank to provide permanent financing through a sale/leaseback arrangement.

- A Principal of BQE interviewed for the case study reported that NYGB's due diligence and work with the company to structure its transactions helped BQE meet private lender requirements. By contrast, other developers cited banker and investor education on the technical, regulatory, and financial aspects of community and commercial/industrial solar as a major barrier to financing their projects. In the absence of such education, investors perceived a heightened level of risk resulting in reduced availability and/or higher cost of available funding.

- Evidence from the Bank of America Merrill Lynch Case Study. NYGB supplemented equipment leases from Bank of America Merrill Lynch ("**BofA Merrill**") to a non-profit nursing home and a public-school district to support long-term loans for energy efficiency projects. The transaction enabled BofA Merrill to extend the term of the lease beyond limits set by its internal policies while maintaining an acceptable risk/return profile. The extended term reduces annual lease repayments and aligns the borrowers' repayment schedules with the anticipated timing of energy cost savings. The lower annual costs and added flexibility enable the borrowers to undertake deeper and more extensive energy efficiency retrofits than would have been possible in the absence of NYGB's participation.

- Community solar project developers participating in conferences in 2017 and 2018 reported that it was becoming easier to find banks and equity investor interested in providing financial support for their projects.[14]

Evidence of NYGB Influence.

- The market actor surveys and the BQE and BofA Merrill Case Studies provide evidence that NYGB contributed to greater understanding among decision makers in financial institutions of the risk/return profiles for clean energy projects. After three successful projects, BQE was able to attract the participation of a commercial bank in the long-term financing of two subsequent projects. This development demonstrates increased comfort on the part of commercial lenders with the risk/return profile presented by BQE's commercial/industrial solar projects.

[14] Keith Martin, Moderator, Current Issues in Community Solar, Infocast Community Solar 2.0, New Orleans, November 2018. https://projectfinance.law/publications/current-issues-in-community-solar-projects. Please note these remarks refer to the community solar market nation-wide, not necessarily to conditions in New York.

Robustness Assessment.

Direction • Participant and Non-Participant Finance and Developer Surveys • Mosaic, BQ Energy and Bank of America Case Studies Influence • Participant and Non-Participant Finance and Developer Surveys • Bank of America Case Study	**Strong**

2.3.5. Increase in the Scale of Individual Clean Energy Project Financing Transactions (Mid-Term Market Indicator)

Definition: Increase over time in the average size or characteristic range of sizes for clean energy projects or financial transactions of a given type.

Table 11. Market Indicator Assessment: Increase in the Scale of Individual Clean Energy Project Financing Transactions

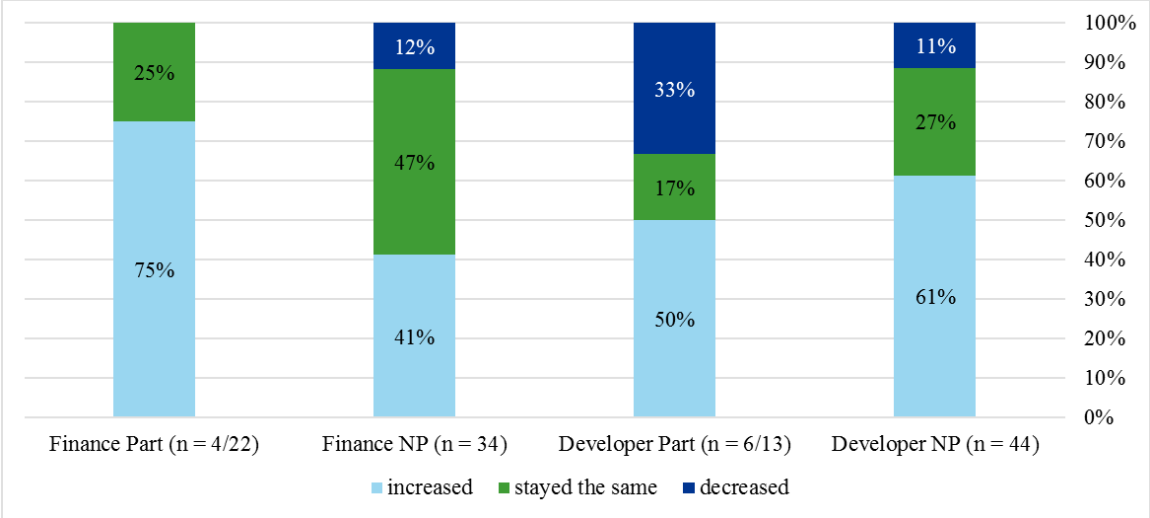
Evidence of Change as Hypothesized by Logic Model	**S**	**I**	**M**
Evidence of NYGB Influence	**S**	**I**	**M**

S = Strong I = Intermediate M = Minimal

Evidence of Current Condition/Direction of Change.

- Survey respondents from all sample groups reported an increase in the dollar volume of their clean energy investments relative to their first year participating in the sector as developers or financiers (Figure 4). Three of the four financial counterparties reported an increased level of investment in clean energy projects versus 41% of financial Non-Participants. Among financial Participants, the respondents reporting no change in clean energy investments had only been in the market one year. Of the respondents who said their clean energy investments decreased, two entered the market in 2013, one in 2015 and one in 2017. As discussed in Section 2.3.11, the volume of clean energy project activity has fluctuated markedly in the past four years, so it is reasonable that some respondents reported reduced levels of activity.
- Most developers reported an increase in clean energy project investments over the same period. The pattern of developer responses did not vary by the length of time they had been active in the market.

Figure 4. Change in Clean Energy Investments ($) from First Year of Investment to 2018



- The Mosaic case study exemplifies the role of NYGB in influencing the scale of clean energy financing transactions. In April 2016, Guggenheim Partners approached NYGB to participate in a credit facility for Mosaic that was undersubscribed by traditional capital sources. In August 2016, NYGB increased its commitment. By February 2017, Mosaic closed its first credit-rated securitization for $140 million. Mosaic issued four additional securitizations for $310 million, $235 million, $315 million, and $260 million between October 2017 and January 2019. These issues have attracted the participation of over 30 investors. [15]

Evidence of NYGB Influence.

- DNV GL's primary and secondary research and case study analysis support the conclusion that NYGB's activities have increased the scale of individual clean energy project financing transactions in NYS.

[15] Mond, Allison. 2017.'Solar securitizations expected to pass $1 billion in 2017". *Greentech Media.* November 2017 https://www.greentechmedia.com/articles/read/solar-securitizations-expected-to-pass-1-billion-in-2017#gs.QLp8fINu.

Robustness Assessment.

Direction	
• Participant and Non-Participant Finance and Developer Surveys • Mosaic Case Study • Mond, Allison. 2017. "Solar securitizations expected to pass $1 billion in 2017". *Greentech Media.* November 2017 https://www.greentechmedia.com/articles/read/solar-securitizations-expected-to-pass-1-billion-in-2017#gs.QLp8fINu	**Strong**
Influence	
• Participant and Non-Participant Finance and Developer Surveys • Mosaic Case Study • Mond, Allison. 2017.'Solar securitizations expected to pass $1 billion in 2017". *Greentech Media.* November 2017 https://www.greentechmedia.com/articles/read/solar-securitizations-expected-to-pass-1-billion-in-2017#gs.QLp8fINu	

2.3.6. Increase in the Number of Clean Energy Financings (Mid-Term/Long-Term Market Indicator)

Definition: Increase over time in the number of clean energy project financings of a given type of financial product.

Table 12. Market Indicator Assessment: Increase in the Number of Clean Energy Financings

Evidence of Change as Hypothesized by Logic Model	**S**	**I**	**M**
Evidence of NYGB Influence	**S**	**I**	**M**

S = Strong I = Intermediate M = Minimal

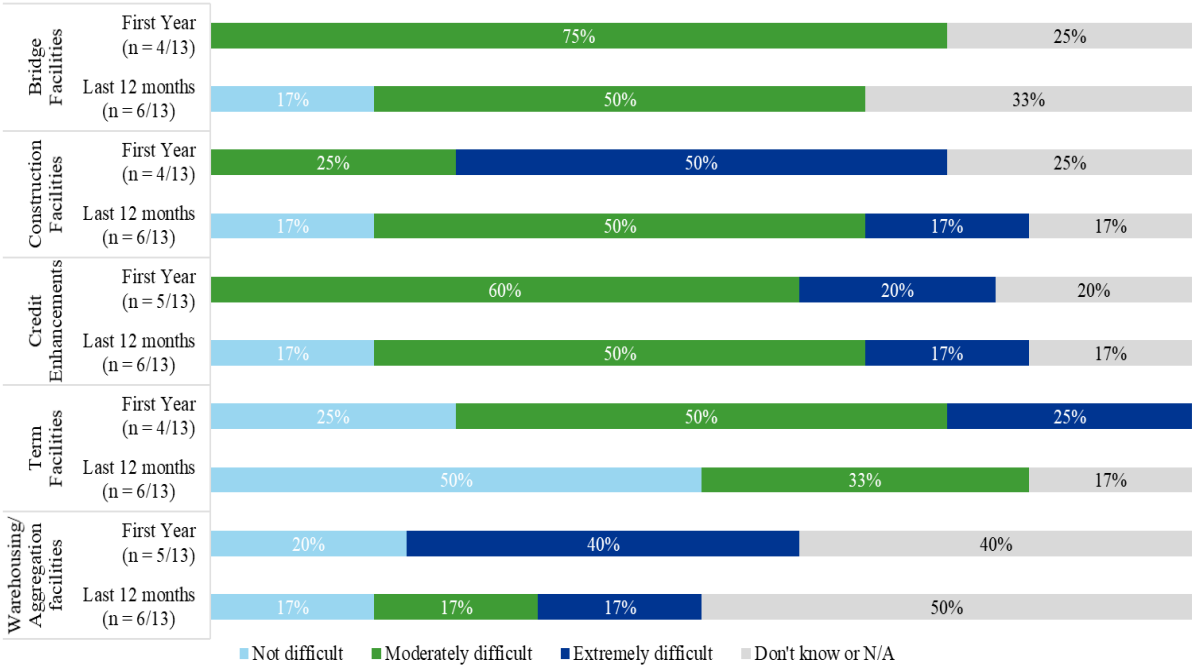
Evidence of Current Condition/Direction of Change.

- Experienced developers active in the market before 2016 reported in the DNV GL survey that obtaining financing for their projects had not constituted a major problem in recent years. Participant developers reported their ability to secure different types of financing increased across all financial product types since the first year they entered the clean energy market (see Figure 5). Non-Participant developers said that they had experienced little to moderate difficulty securing financing during 2018. The questions on which these results were based were not structured to support analysis of disaggregation of results to specific geographic markets such as states or regions. Therefore, DNV GL cannot be certain that survey participant responses describe their ability to secure financing for clean energy projects in NYS.

- The number of residential solar securitizations issued per year on a national basis increased from two in 2015 to eight in 2018.[16] NYGB had participated in earlier stage aggregation facilities for five of the ten top issuers of rated solar securitizations during this period.

- The annual number of community solar projects with applications to the Megawatt Block program increased from five in 2015 to 197 in 2017. The number of applications dropped to 57 in 2018, most likely due to the filling up of the early blocks and uncertainties over proposed changes in net metering regulations in NYS. Net metering regulations address the project eligibility, pricing, and mechanism through which owners of distributed energy resources such as solar are compensated for excess electricity their PV systems produce beyond the needs of the host facilities.

Figure 5. Difficulty in Securing Financing: First Year of Clean Energy Investment Compared to the Last 12 Months (Participating Developers)



Evidence of NYGB Influence.

- NYSERDA and NYGB hypothesized that, over the mid/long term, the number of clean energy project financings would increase as a result of NYGB activity. The Study Period covers only the short-term period. Nonetheless, NYGB activities during the period had a demonstrable impact on the increase in residential solar securitizations.

[16] PV Magazine, Greentech Media.

Robustness Assessment.

Direction • Participant and Non-Participant Developer Surveys • PV Magazine, Greentech Media. Influence • Participant and Non-Participant Developer Surveys • PV Magazine, Greentech Media.	**Intermediate**

2.3.7. Increase in the Number of Financiers Offering Products Supported by NYGB (Mid-Term/Long-Term Market Indicator)[17]

Definition: Increase over time in the number and type of financiers offering financial products similar to those offered by NYGB.

Table 13. Market Indicator Assessment: Increase in the Number of Financiers Offering Products Supported by NYGB

Evidence of Change as Hypothesized by Logic Model	**S**	**I**	**M**
Evidence of NYGB Influence	**S**	**I**	**M**

S=Strong I=Intermediate M = Minimal

Evidence of Current Condition/Direction of Change.

- Both the Mosaic case study and secondary research provided evidence that the number of financial institutions offering products similar to those offered by NYGB increased during the Study Period. Four residential solar financing providers other than Mosaic are now offering solar loans financed through loan aggregation facilities similar to those supported by NYGB.[18] Furthermore, a panel of renewable energy project finance executives reported an increase in the number of companies active in the renewable project finance market from 2017 to 2018 with the number of tax equity investors expanding from 25 to 35.[19]

[17] DNV GL interpreted this indicator as the number of financiers offering products similar to those in which NYGB participated - not as the number of financial counterparties or partners working with or participating in financial transactions with NYGB.

[18] Weaver, op. cit.

[19] Bloomberg New Energy Finance, "Clean Energy Investment Trends", 2017, https://data.bloomberglp.com/bnef/sites/14/2018/01/BNEF-Clean-Energy-Investment-Investment-Trends-2017.pdf?elqTrackId=2e6e6b2aa1f946bca67cd74d9e20babb&elq=b4bc4a4f1fe649c89f85ec1318feb73f&elqaid=10316&elqat=1&elqCampaignId=.

.

- Data collected from the survey was less conclusive. Financial Participants were asked if their firms offered services and products for clean energy transactions that were similar to those offered by NYGB. The responses were equally distributed between "yes" and "no." The distribution of responses was similar for Participant developers who were asked if other financing entities offered products similar to NYGB's offerings.

- Community solar developers have reported an increase in the number and variety of financial institutions and investors active in the sector. Early in the development of community solar projects (i.e., 2015), capital was provided primarily by small, unregulated investors. As of the end of 2018, the range of institutions and investors active in community and commercial/industrial solar projects financed by NYGB and the market at large has expanded even though this asset class is still in early stages of development. Investors now include commercial banks, insurance companies, specialty lenders, and syndicates of financial institutions as lenders and tax equity investors[20]

- Not all evidence gathered pointed to increasing number of financiers in clean energy markets. For example, Vivint Solar stated in its 2019 Form 10-K that investment funds are limited and there is significant competition for investment capital among clean energy developers.[21]

Evidence of NYGB Influence.

- DNV GL's research identified evidence to support an increase in the number and type of clean energy financiers in NYS offering financial products similar to those offered by NYGB. However, more time is needed to demonstrate a causal effect of NYGB's activities on the market indicator.

[20] Solar Energy Industries Association, Major Solar Projects Directory, 2018, http://www.seia.org/research-resources/major-solar-projects-list.
Also, Keith Martin, Moderator, Current Issues in Community Solar, Infocast Community Solar 2.0, New Orleans, November 2018. https://projectfinance.law/publications/current-issues-in-community-solar-projects. Please note these remarks refer to the community solar market nation-wide, not necessarily to conditions in New York.

[21] Vivint Solar, op cit.

Robustness Assessment.

Direction • Mosaic and BQE Case Studies • Bloomberg New Energy Finance, "Clean Energy Investment Trends", 2017 • Solar Energy Industry Association Projects Directory • Vivint 2019 Form 10-K Influence • Mosaic Case Study • Bloomberg New Energy Finance, "Clean Energy Investment Trends", 2017	**Intermediate**

2.3.8. Replication by Developers of NYGB Financing Approaches – Residential/Commercial (Mid-Term/Long-Term Market Indicator)

Definition: Increase in reported of use of financing approaches that are the same or similar to those used in NYGB transactions.

Table 14. Market Indicator Assessment: Replication of Financial Model by Developers

Residential Market.

Evidence of Change as Hypothesized by Logic Model	**S**	**I**	**M**
Evidence of NYGB Influence	**S**	**I**	**M**

Commercial Market.

Evidence of Change as Hypothesized by Logic Model	**S**	**I**	**M**
Evidence of NYGB Influence	**S**	**I**	**M**

S = Strong I = Intermediate M = Minimal

DNV GL presents separate findings for NYGB activities targeted to the residential and commercial sectors because the strength and quality of the evidence on NYGB influence differ between the two.

Residential Sector: Evidence of Current Conditions/Direction of Change.

- Growth in securitization of residential solar loans. As shown later in Figure 9, the volume of residential solar loan, lease, and PPA securitizations grew rapidly during the Study Period.
- Increase in number of firms issuing residential solar loan securitizations. At least nine companies now offer residential solar loan products. Of those, DNV GL identified securitizations issued by five companies: Mosaic, Sunlight Solar, Sunnova Solar Energy, Dividend Solar Finance, and Tesla/Solar City.[22]

Residential Sector: Evidence of NYGB Influence.

Mosaic was the first to develop the solar loan business model and the first to issue a sizeable securitization of residential solar loans. The rapid adoption of similar business and finance models by at least four other firms attests to Mosaic's influence on the market. NYGB participated in the first warehouse credit facility, which provided the operating experience needed to support the rating of the first securitization. The structure of the securitization became known in the market and led to adoption by other developers and financiers.

Given consistent evidence that developers and financiers have replicated Mosaic's approach and that NYGB contributed materially to the development of that approach, this indicator is rated as "Strong".

Commercial Sector: Evidence of Current Conditions/Direction of Change.

DNV GL reviewed documentation of all NYGB projects located on or sponsored by commercial facilities, as well as the Non-Participant survey results and industry press to search for evidence of replication of financing models or the use of NYGB experience as a reference project for assessing pricing and risk. This effort yielded little evidence of replication of NYGB approaches within or outside the portfolio. One exception was the use of bridge lending to finance interconnection construction for five community solar developers in the NYGB portfolio. DNV GL was unable to identify similar types of financing employed by other developers.

[22] Beryl Ajwang, "Securitization of Solar Finance Continues to Grow", May 15, 2018, *Clean Energy Finance Forum.* https://cleanenergyfinanceforum.com/2018/05/15/securitization-of-solar-finance-continues-to-grow.

Commercial Sector: Evidence of NYGB Influence.

DNV GL found little evidence of NYGB influence on adoption of similar financing approaches by commercial sector facilities or the commercial sector energy services providers.

Robustness Assessment.

Residential.

Direction	
• Julia Pyper, "Solar Loans Emerge as Dominant Residential Financing Product", Greentech Media, November 14, 2018. https://www.greentechmedia.com/articles/read/solar-loans-are-now-the-dominant-financing-product#gs.22pnrf • Christian Roselund, " Solar loans overtake third-party as dominant residential solar model", July 11, 2018, https://pv-magazine-usa.com/2018/07/11/solar-loans-overtake-third-party-ownership-as-dominant-residential-solar-model/ • Beryl Ajwang, "Securitization of Solar Finance Continues to Grow", May 15, 2018, Clean Energy Finance Forum. https://cleanenergyfinanceforum.com/2018/05/15/securitization-of-solar-finance-continues-to-grow	**Intermediate**
Influence	
• Case Studies	

Commercial.

Direction	
• Market Actor Surveys • NYGB Internal documents.	**Minimal**
Influence	
• Case Studies	

2.3.9. Total Volume of Clean Energy Project Financings (Long-Term Market Indicator)

Definition: Increase over time in the dollar volume of clean energy project financings of a given type.

Table 15. Market Indicator Assessment: Increased Total Volume ($) of Clean Energy Financing Transactions

Evidence of Change as Hypothesized by Logic Model	S	I	M
Evidence of NYGB Influence	S	I	M

S = Strong I = Intermediate M = Minimal

Evidence of Current Condition/Direction of Change.

- Survey respondents reported an increase in the ability to secure financing as well as an increase in the scale of projects, which can be indicative of an increase in the overall volume of clean energy financing transactions.
- The Mosaic case study and secondary data provided strong evidence for the increase in volume in the clean energy market (see Figure 9 below for more information) with the volume of residential solar aggregation financings increased significantly in the period under review.

Evidence of NYGB Influence.

- DNV GL's research identified intermediate evidence that NYGB investment activities and product offerings resulted in an increase in the dollar volume of clean energy financings in NYS. More time is needed for the market to mature to fully determine NYGB's influence on the volume of clean energy transactions.

Robustness Assessment.

Direction • Participant and Non-participant Finance and Developer Surveys • Mosaic Case Study Influence • Participant and Non-participant Finance and Developer Surveys • Mosaic Case Study	**Intermediate**

2.3.10. Increase in the Volume of Clean Energy Projects (Long-Term Market Indicator)

Definition: Increase in the number, capacity, or dollar volume of clean energy projects of a given type in a given market segment in New York State

Table 16. Market Indicator Assessment: Increased Total Volume of Project Financings

Residential Market

Evidence of Change as Hypothesized by Logic Model	S	I	M
Evidence of NYGB Influence	S	I	M

Commercial Market

Evidence of Change as Hypothesized by Logic Model	S	I	M
Evidence of NYGB Influence	S	I	M

S = Strong I = Intermediate M = Minimal

The Study presents separate findings for NYGB activities targeted to the residential and commercial sectors because these represent distinct segments of the clean energy market and the strength and quality of the evidence on NYGB influence differ between the two.

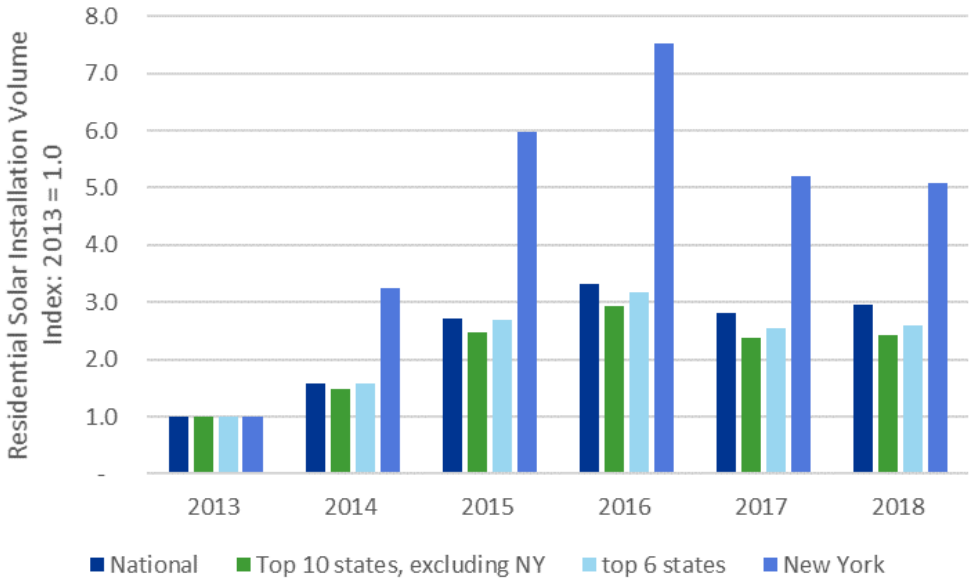
Residential Sector: Evidence of Current Conditions/Direction of Change.

- NYGB invested heavily in the residential solar finance sector in NYS. Between early 2016 and May 2017, NYGB participated in six warehousing/aggregation transactions backed by loans, leases, or power purchase agreements for residential solar projects. The lending supported by these transactions supported roughly 38% of total residential solar PV capacity installed in NYS in the years 2016 through 2018.[23]
- The volume of residential solar installations declined between 2016 and 2018 in NYS as it did in other states with high volumes of residential solar PV installations, but to a lesser extent. If

[23]DNV GL analysis based on NYGB records and data on solar installations from Wood Mackenzie.

NYGB's support for residential solar project financing had stimulated the consumer market, it is expected that solar installations in NYS would be higher than they are in states that also experienced high levels of solar installations in 2013 and that have also moved beyond the "early adopter" stage. As Figure 6 shows the change in the volume of solar installations in NYS followed a similar trend as installations in other states with high levels of residential solar PV sales. However, installations in NYS, compared to 2013 installation levels, remained farther above comparable installations in these states.

Figure 6. Indexed Annual Volume of Residential Solar PV Installed: New York, U.S., and other Leading States (2013 = 1.0)



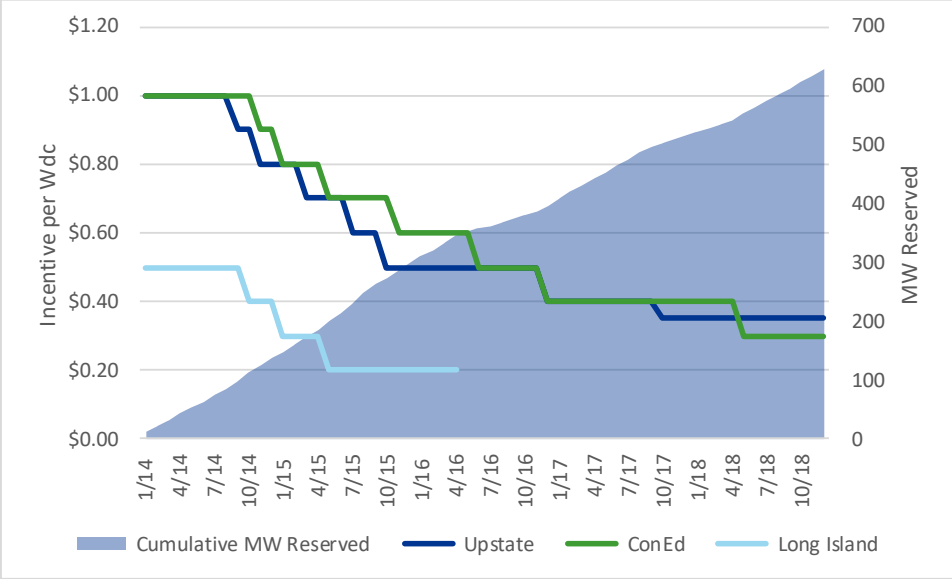
Source: Wood, Mackenzie Power & Renewables

Residential Sector: Evidence of NYGB Influence.

There were many other economic influences at work on the residential solar market in New York during the period under review.

- NYS launched a cash incentive program for residential solar PV in the two years prior to NYGB's investments. Beginning in January 2014, the NY-Sun Megawatt Block program made cash incentives available to homeowners who installed rooftop solar PV. The incentives were structured in tranches by three regions, with declining values over time. Figure 7 displays the level of incentives per $Watt_{dc}$ installed through the program, along with the cumulative nameplate capacity of the projects receiving incentives. Despite reductions in the level of the incentives, the volume of installations supported by the program remained stable through the period under review.

Figure 7. Incentives Paid by the Residential NY-Sun Megawatt Block Program and Cumulative Volume of MW for Supported Projects[24]



Measures of the Megawatt Block program's intervention into the NYS residential solar market include the following:

- NY-Sun paid out $152 million in incentives for residential projects during the Study Period v. $282 million in investments in residential solar financing vehicles from NYGB. Not all of these investments were deployed in NYS.
- The value of residential projects that received NY Sun incentives during the study period was $1.75 billion v. $566 million for NYGB investments.
- NY-Sun incentives are limited and decrease in terms of $/watt over time, providing customers with some urgency to act.
- Between 2014 and 2018, the Megawatt Block program paid incentives for 85% of the total residential capacity installed in NYS.

- Uncertainty over net metering regime. Through a process initiated in 2015, the New York Public Service Commission ("**PSC**") significantly revised the State's net metering rules and pricing. These changes were summarized in a decision dated March 2017 and implemented in an order dated September 2017.[25] Most residential customers will remain eligible for net metering through 2020. However, the uncertainty over the outcome of the proceeding may have deterred some potential customers from installing solar PV systems

[24] DNV GL analysis based on NYSERDA, Solar Electric Programs Dataset, 2000 – 2018.
[25] State of New York Public Service Commission. Order on Phase One Value of Distributed Energy Resources Implementation Proposals, Cost Mitigation Issues, and Related Matters. Case 15E-0751 – In the Matter of the Value of Distributed Energy Resources. September 14, 2017.

on their homes. Also, given that the pay-back periods of rooftop solar systems are more than just a few years, uncertainty around the post-2020 economic situation would also be expected to have a chilling effect until the succeeding principles of the Value of Distributed Energy Resources ("**VDER**") are well-understood in NYS.

The evidence of NYGB's influence on the volume of residential solar PV installed in New York during the Study Period was mixed. Applying the scoring rubric discussed in Section 2.1, this indicator is characterized as Intermediate at this stage. Subsequent studies will continue to monitor project volumes as Megawatt Block incentives are exhausted.

Commercial Sector: Evidence of Current Conditions/Direction of Change.

Most of the evidence on NYGB's effect on the volume of clean energy projects completed in the commercial sector comes from an assessment of the community and commercial/industrial solar markets conducted as part of a case study for this Report.

NYGB concentrated considerable resources on the community and commercial/industrial solar market. It worked with seven project developers and committed $183 million to a wide range of financial products to meet counterparty needs. These include:

- Bridge Loans for Interconnection Costs. NYGB created bridge loan facilities for three developers to finance interconnection advance payments and therefore allow for a more efficient use of sponsor and development equity.

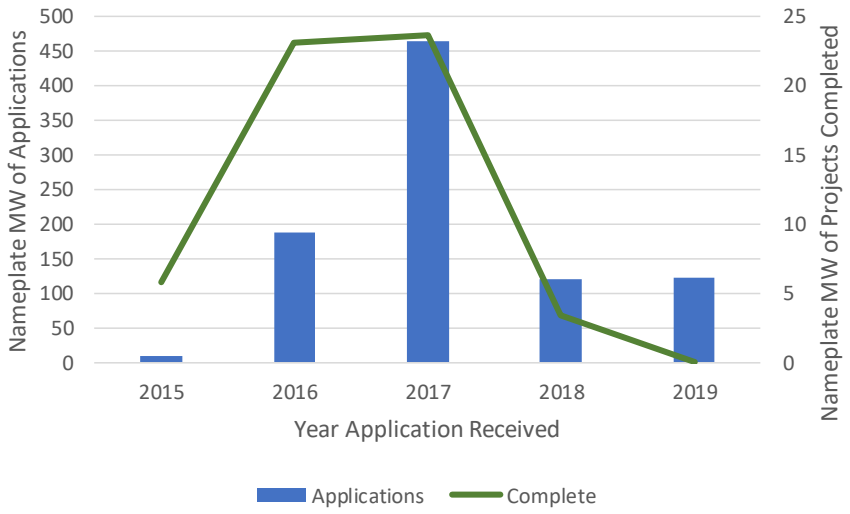
- Construction Lending. NYGB provided construction loans to five of the seven developers to expedite and finance completion of their projects, taking on construction risk and providing a bridge to commercial operations. The volume of market participants willing and able to invest in operational energy assets is generally larger than that for assets in development or under construction.

- Term Loans and Refinancing. NYGB provided term loans to finance new projects and to refinance existing projects so that the developer's capital could be freed up for additional projects.

Most of the community and commercial/industrial solar transactions in NYGB's portfolio provide two or more of the products discussed above to facilitate the progress of projects from one phase to the next. Since the resolution of uncertainties around net metering and the adoption of VDER, developers consistently identify NYS as an attractive state in which to pursue community solar opportunities due to an established revenue and metering regime and presence of community

choice aggregation.[26] Figure 8 displays the total MW of community solar projects for which the Megawatt Block program received applications and the capacity of projects designated as complete by the year the application was received. Given the relative simplicity of applying for Megawatt Block support, the NY-Sun database likely reflects a mostly complete inventory of projects under development in the State.

Figure 8. Nameplate MW of Megawatt Block Community Solar Applications and Projects Completed by Year Application Received



The volume of applications increased rapidly from 8.6 MW in 2015 to 465.8 MW in 2017. It then decreased to 120.2 MW in 2018. During this period, the installed capacity of community solar nationwide increased by 33%.[27] The pace of Megawatt Block applications for community solar projects picked up considerably in the first two months of 2019, already equalling 2018 applications. The volume of projects completed during the 2015-2018 period follows a similar trajectory as the applications. The market constriction observed in 2018 most likely reflects the effects of uncertainty over the outcome of the PSC's proceeding to revise regulations on net metering. It may also reflect investor uncertainty over the outcome of federal corporate tax reform. Proposed reductions in corporate tax rates would have reduced the value of investments for tax equity investors. In June 2018, NYSERDA announced a redesign of NY-Sun's Megawatt Block Program for non-residential and large commercial and industrial solar projects. The redesign, made in response to a rapidly-changing market, includes expanding incentives,

[26] See, for example, Keith Martin, Moderator, Current Issues in Community Solar, Infocast Community Solar 2.0, New Orleans, November 2018. https://projectfinance.law/publications/current-issues-in-community-solar-projects.

[27] GTM/Wood Mackenzie, cited in Solstice, "What's behind the explosive growth in the Community Solar Market. https://solstice.us/solstice-blog/explosive-growth-in-the-community-solar-market/,

supporting larger solar projects and encouraging development in a greater variety of locations, including brownfields, landfills, and at affordable housing locations.

Commercial Sector: Evidence of NYGB Influence

As Table 17 shows, NYGB has been very active in the NYS community and commercial/industrial solar markets. Projects undertaken by NYGB counterparties in those market segments account for one-third of the capacity registered as completed or in the pipeline in the NY-Sun project database.

Table 18: Share of Nameplate Capacity of Community and Commercial/Industrial Solar Projects: 2016 - 2018

	Project Status		
	Complete	Pipeline	Total
NY Green Bank Counterparties	32%	34%	34%
Other Projects	68%	66%	66%
Total	100%	100%	100%

Source: NY-Sun Project Database

Despite this high level of involvement, the Study team views the evidence on the effect of NYGB incentives on commercial project volume as minimal. The increase in volume of community solar projects completed nationwide was steady from 2016 through 2018.[28] In contrast, community and commercial/industrial project volume in NYS decreased precipitously in 2018, most likely due to uncertainty over regulatory policies towards net metering. It is too early to assess installation in trends in 2019 and the extent of NYGB influence on those trends.

Robustness Assessment.

Residential Market.

Direction • DNV GL analysis based on NYGB records and data on solar installations from Wood Mackenzie. Influence • DNV GL analysis based on NYSERDA, Solar Electric Programs Dataset, 2000 – 2018	**Strong**

[28] GTM/Wood Mackenzie, op. cit.

Commercial Market.

Direction • Keith Martin, Moderator, Current Issues in Community Solar, Infocast Community Solar 2.0, New Orleans, November 2018. https://projectfinance.law/publications/current-issues-in-community-solar-projects • Megawatt Block Program • NY-Sun Database Influence • GTM/Wood Mackenzie, cited in Solstice, "What's behind the explosive growth in the Community Solar Market. https://solstice.us/solstice-blog/explosive-growth-in-the-community-solar-market • Megawatt Block Program	**Intermediate**

2.3.11. Emergence of Secondary Markets (Long-Term Market Indicator)

Definition: Increase over time in the volume of sales of loan or lease cash flows into secondary markets, either directly or through securitization.

Table 19. Market Indicator Assessment: Emergence of Secondary Markets

Evidence of Change as Hypothesized by Logic Model	S	I	M
Evidence of NYGB Influence	S	I	M

S = Strong I = Intermediate M = Minimal

Evidence of Current Conditions/Direction of Change.

The pace of growth of secondary markets varies by clean energy market and technology segment.

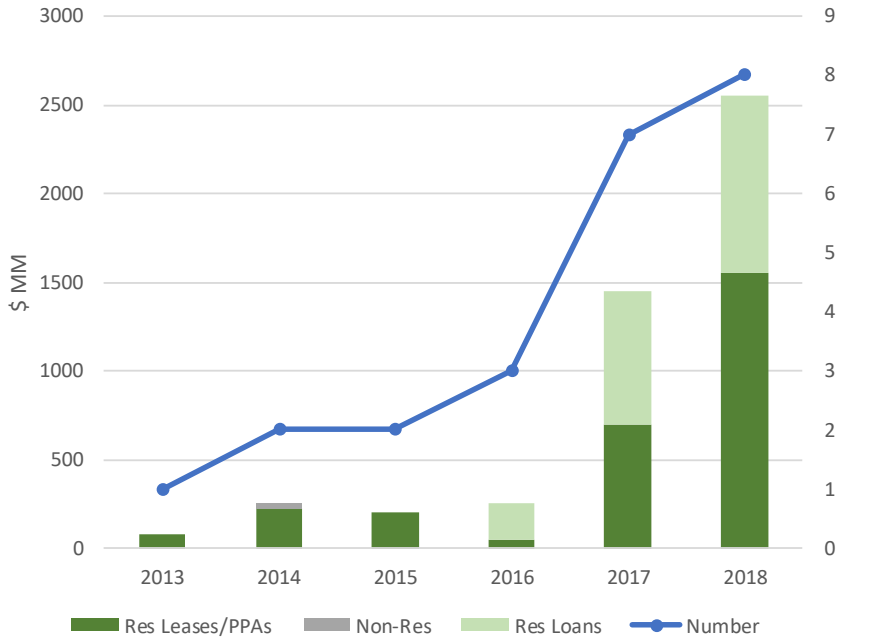
- Residential solar market. In 2018, 74% of all residential solar installations, measured by installed capacity, were financed as opposed to purchased for cash. Approximately 42% percent of the capacity installed was financed through leases and PPAs, all of which were sold into the secondary market. Thirty-three percent of the capacity was financed through loans.[29]

  As Figure 9 shows, total annual solar PV securitizations in the U.S. grew steadily from $250 million in 2016 to $2.6 billion in 2018, with Mosaic accounting for nearly 40% of the volume of national residential solar securitizations in 2017 and 2018.[30] Mosaic

[29] Weaver. op. cit.
[30] PV Magazine, Greentech Media.

stakeholders attributed investor uptake of securitizations to NYGB's support of Mosaic's initial credit facility.

Figure 9. Annual Residential Solar Securitizations by Number, Volume, and Asset Type



Source: PV Magazine, Greentech Media

- Community Solar Market. To date, DNV GL has found no evidence of the sale of loans to finance community solar into a secondary market. Developers in the industry voice the opinion that community and commercial industrial solar portfolios are too small and heterogeneous at the moment for securitizations, reflecting the less developed nature of this growing asset class as compared with residential solar.[31]

- Energy Efficiency. To date, DNV GL has found no evidence of a secondary market for streams of interest and principal or energy performance contract payments derived from energy efficiency projects. Nearly 80% of these contracts are with government or non-profit agencies that have access to tax-exempt financing, often at low interest rates.[32] These entities are generally able to obtain municipal leases to finance assets. Therefore, it is unclear whether there is yet a strong case for undertaking the work needed to structure secondary markets for these leases and loans, although this may be expected to develop in the future as this asset class also reaches critical volumes.

[31] Keith Martin. Proceedings of the 2017 Wall Street Renewable Energy Finance Forum, Norton Rose Fulbright LLP.
[32] Ameresco, Inc. 2017 Annual Report. http://www.annualreports.com/HostedData/AnnualReports/PDF/NYSE_AMRC_2017.pdf .

Based on these findings from the residential solar market, where secondary markets have begun to emerge, DNV GL scores the Direction of Change as Intermediate.

Evidence of NYGB Influence.

As discussed earlier, financing from NYGB was instrumental in enabling Mosaic to scale its operations, which in turn helped the company arrange its first term securitization. Mosaic's activities account for a significant portion of total residential solar loan securitizations nationally. Participants in the community and commercial/industrial solar markets believe that portfolios of projects in that industry are not sufficiently large to support the development of secondary markets for project debt, although they believe that such markets may develop in the future.[33,34]

Experience during the Study Period provides additional examples of private investors paying down NYGB's investment positions. These include:

- Private term lending to retire construction loans that NYGB made to the New York City Housing Authority ("**NYCHA**") for energy efficiency projects.
- Private investment in community solar projects initiated by Distributed Sun, LLC and its affiliate SUNEIGHT that paid down NYGB bridge loans used to finance advance payments for utility interconnection construction.
- Early retirement of NYGB loans to Motivate International, Inc., a bike share system operator, upon the firm's acquisition by Lyft.

These transactions provide evidence of private investor interest in transactions initiated by NYGB. The NYCHA and Distributed Sun transactions suggest the potential for aggregation associated with secondary markets. Future phases of the NY Green Bank Market Transformation Study will continue to monitor clean energy industries for development of secondary markets.

[33] Martin, 2017. op. cit.

[34] Secondary Market: A secondary market in finance is a market where securities such as stocks and bonds are traded among investors. In this case, the securities would entitle their owner to a share of the principal and interest payments on loans issued to finance community or commercial/industrial solar projects.

Robustness Assessment.

Direction	
• Case Studies • John Weaver, "Cash is king in residential solar, long live the lease!" PV Magazine, November 14, 2018. https://pv-magazine-usa.com/2018/11/14/cash-is-king-in-residential-solar-long-live-the-lease/ • PV Magazine, Greentech Media. • Keith Martin. Proceedings of the 2017 Wall Street Renewable Energy Finance Forum, Norton Rose Fulbright LLP • Ameresco, Inc. 2017 Annual Report. http://www.annualreports.com/HostedData/AnnualReports/PDF/NYSE_AMRC_2017.pdf	**Intermediate**
Influence	
• Case Studies	

2.3.12. Reduction in Financing Costs (Long-Term Market Indicator)

Definition: Reduction in costs of financing a given type of transaction, including interest rates, advance rates (sponsor equity requirements), and fees.

Table 20: Market Indicator Assessment: Reduction in Financing Costs

Evidence of Change as Hypothesized by Logic Model	**S**	**I**	**M**
Evidence of NYGB Influence	**S**	**I**	**M**

S = Strong I = Intermediate M = Minimal

Evidence of Current Conditions/Direction of Change.

Evidence collected for this Study suggests that costs of financing differ between clean technology market sectors.

- Mosaic's borrowing costs (as measured by the spread above a London Inter-bank Offered Rate ("**LIBOR**") benchmark) decreased over significantly in successive securitizations. The reduction in Mosaic's borrowing costs reflects the results of the high credit rating that Mosaic's term securitizations received, based in part on credit experience gained through the warehouse credit facility that NYGB financed.
- Interest rates on aggregations and securitizations of residential solar leases and PPAs in which NYGB participated decreased during the Study Period.

- Developers and financiers participating in a 2017 panel on residential solar financing reported that interest rates were decreasing at a pace consistent with Mosaic's experience.[35]

- The average advance rate on credit facilities for solar loans increased from 62% in 2013 to 80% in 2018. The advance rate is the share of project financing provided by investors, as a proportion of a defined "borrowing base" which broadly reflects the value of projects being financed. Project developers and sponsors benefit from increased advance rates in several ways. First, a higher advance rate shifts a larger share of total project risk to the investors. Second, it reduces the amount of sponsor or outside equity needed to fund a given quantity of project costs, and thus reduces the total cost of financing.[36]

- Within NYGB's portfolio, interest rates for community and commercial/industrial solar transactions have not decreased over the 2015-2018 Study Period. For example, interest rates (spread above the LIBOR benchmark) and fees for the five BQE transactions remained constant. This experience was consistent with remarks by community solar developers at a 2018 seminar and reflective of the continued development of these asset classes.[37]

Based on these findings, DNV GL scores the Direction of Change of this indicator as Intermediate.

Evidence of NYGB Influence. NYGB's participation in the first, large-scale credit warehouse facility helped Mosaic accumulate the credit experience it needed to obtain an "A" credit rating for a term securitization. That credit rating enabled Mosaic to obtain a lower interest rate than it had previously paid for debt to be used in financing customer projects. Mosaic, and other residential solar companies, have been able to increase the advance rates in credit aggregation transactions over time. This development reduces the overall costs of capital by reducing requirements for equity from outside investors, which is usually more expensive than debt for the project sponsor. DNV GL did not find similar trends in the community solar, commercial/industrial solar, or commercial energy efficiency markets examined in the case studies. Given these findings, DNV GL assigned an Intermediate scoring to this indicator.

[35]Martin, Keith, Moderator, "Current Issues in Community", Solar, Infocast Community Solar 2.0, New Orleans, November 2018, https://projectfinance.law/publications/current-issues-in-community-solar-projects.
[36] Feldman, David and Paul Schwabe. 2018. *Terms, Trends, and Insights on PV Project Finance in the United States*. 2018 National Renewable Energy Laboratory. November 2018.
[37] Martin, 2018, op. cit.

Robustness Assessment.

Direction	
• Case Studies • Martin, Keith, Moderator, "Current Issues in Community", Solar, Infocast Community Solar 2.0, New Orleans, November 2018, https://projectfinance.law/publications/current-issues-in-community-solar-projects. • Feldman, David and Paul Schwabe. 2018. Terms, Trends, and Insights on PV Project Finance in the United States. 2018 National Renewable Energy Laboratory. November 2018. • U.S. Securities and Exchange Commission, Plug Power, 10-K for fiscal year ending 12/31/2018, US Securities Exchange Commission, 2019. • U.S. Securities and Exchange Commission, Vivint Solar, 10-K for fiscal year ending 12/31/2018, US Securities Exchange Commission, 2019.	**Intermediate**
Influence	
• Case Studies	

2.3.13. Reduced Elapsed Time to Complete Transactions (Long-Term Market Indicator)

Definition: Change in the amount of time needed between initial application for financing and closing the financial transaction, for a given financial product or type of transaction.

Table 21. Market Indicator Assessment: Timeframe for Transaction Execution

Evidence of Change as Hypothesized by Logic Model	**S**	**I**	**M**
Evidence of NYGB Influence	**S**	**I**	**M**

S = Strong I = Intermediate M = Minimal

Evidence of Current Conditions/Direction of Change.

Evidence on trends in the elapsed time required to complete transactions and the effects of working with NYGB on transaction process and closing times is mixed.

- Evidence from the market actor surveys. All respondent groups reported that the average time needed to complete financial transactions had decreased in the past year and over the period since the respondent first became involved in the clean energy finance markets. Non-participants reported an average decrease in time to close a transaction of 15% compared to 10% reported by NYGB counterparties. This difference is not significant given the small sample sizes for the survey and may reflect the fact that in operating at

"the near frontier" of clean energy financings, many of NYGB's transactions are first-of-their kind requiring time and effort to create a path to successful closing.

- Evidence from the Mosaic case study. Mosaic greatly accelerated the pace of securitizations after working with NYGB on its first unrated credit facility. The NYGB transaction took five months to close once the application had been initiated. In the 15 months between October 2017 and January 2019, Mosaic completed four securitizations totaling more than $1.1 billion.

Evidence of NYGB Influence.

Evidence gathered to support an assessment of this market indicator suggests that the time to close a transaction has decreased for both Non-Participants and NYGB counterparties. The change has been slightly less pronounced for NYGB counterparties. As transaction closing periods have decreased for both parties, it is difficult to discern whether NYGB has influenced the broader market effects implied in the definition at this time. The Study team therefore assigns a scoring of Minimum to this indicator.

Robustness Assessment.

Direction • Market Actor Surveys • Case Studies • Megawatt Block incentive database Influence • Market Actor Surveys • Case Studies • Megawatt Block incentive database	**Intermediate**

2.3.14. Reduction in Clean Energy Technology Costs (Long-Term Market Indicator)

This Study did not address the NYGB's impact on changes in technology costs. Technology costs are primarily driven at a global level and are not influenced by financing services and activities within a region or state. NYSERDA, NYGB and DNV GL agreed to research this indicator in subsequent studies when more data may be available to facilitate an assessment of NYGB's influence on this indicator.

3. FINDINGS AND CONCLUSIONS

3.1. Conclusions and Summary of Findings

NYGB has made a strong start in achieving its goals. Five years after its formation, and with $637.6 million in overall investments as of December 31, 2018, NYGB has become a more established investment and asset management platform. However, some of NYGB's investments are still in their early stages while the portfolio continues to mature. NYGB's transactions typically involve agreements among multiple parties and often require months to close. In sectors such as community and commercial/industrial solar, for example, the underlying projects typically take 18 – 24 months to plan and complete. The Study Period encompasses the earliest stages of NYGB's financing operations and the market response to those activities.

Given the timeframe of the Study Period and the range of other influences on clean energy finance markets, the DNV GL study team expected to find, at best, modest evidence of NYGB's influence. However, DNV GL identified credible evidence of NYGB's influence on many of the market indicators. The following summarizes the Study's major findings.

The success of the Mosaic transaction demonstrates the efficacy of NYGB's strategy**.** In 2014, Mosaic, Inc. launched a novel business model for financing residential solar systems that reduced the high customer acquisition and financing costs that had begun to inhibit growth in the solar PV industry. By mid-2015, Mosaic needed a large fund from which it could make thousands of loans to homeowners through a nationwide network of participating dealers. In early 2016, NYGB joined one other bank and committed $50 million in two stages to the credit facility which grew to $270 million with the participation of two other financial institutions. Mosaic used the credit and operating experience gained with the warehouse credit facility to support the development of a credit-rated securitization, through which it could access significant sums from large investors on favorable interest terms. Over the next 20 months, Mosaic issued four additional securitizations, raising over $1.1 billion from more than 30 banks and investor groups. After only four years in the market, the Mosaic Solar Loan program commanded 14% of the market for residential solar project financing. Due to the speed and scale of this growth, DNV GL was able to identify links between NYGB activities and positive developments in four of the five market indicator groups.

DNV GL identified changes in many of the evaluated market indicators that were directionally consistent with hypotheses concerning the market effects of NYGB activities. DNV GL also found evidence of NYGB influence on most of these observed changes. However, the evidence was generally not significant enough to support a definitive judgment of a causal relationship

between NYGB activities and the market changes observed. As discussed earlier, DNV GL anticipated this pattern in the findings given that the Study Period covers only the earliest stages of NYGB operation.

The Study found evidence of NYGB's impact on the following market changes:

- Increase in the number of and average size of project financings and their total dollar volume in markets NYGB entered, particularly in residential and community solar.
- Increase in the number and type of financial institutions active in the clean energy finance markets.
- In the residential solar financing market, the Study team found evidence of decreases in costs of capital for transactions that fund loans or leases to customers, the growth of secondary markets, and replication in the structure of transactions in which NYGB played an early role.

Most of the clear evidence on NYGB influence came from the Mosaic case study. NYGB's key role in financing Mosaic's first major credit facility, the importance of the operating information generated by that facility in supporting access to lower-cost securitized financing, the company's rapid growth *within the three-year Study Period,* and the small number of significant competitors in the market support a strong case for NYGB's impact.

It is too early to infer a strong influence of NYGB's activities and the transformation of other markets in which it operates, such as community solar, commercial/industrial solar, and commercial sector energy efficiency. Exogenous factors such as government regulation and industry fragmentation across both developers and financiers, coupled with limited data on market activity made it difficult for the Baseline Assessment and Attribution Analysis to isolate the impact of NYGB. In other cases, the scale of business activity by NYGB's counterparties remained too small during the Study Period to support a plausible argument related to effects on the broader market. It is expected that future studies will identify further evidence of market change and of NYGB influence.

DNV GL identified little consistent evidence of NYGB's influence on one of the key market indicators: financial institution knowledge and confidence in clean energy investments. This indicator was originally anticipated to show change over a short (1-3 year) time frame. In several cases, NYGB's counterparties were first movers willing to make new kinds of investments. Thus, NYGB's investments generated new operating and credit experience that could serve as a guide to structuring similar future transactions. However, the volume of such experience remains too

small for NYGB to aggregate across transaction types and disseminate anonymized data to the market more broadly. Hence, it is too early to detect a strong observable effect of NYGB's activities on financier and developer knowledge and confidence in clean energy investments. Future impact studies may detect a stronger influence of NYGB on this market indicator.

3.2. Recommendations

DNV GL recommends that future phases of the financial market transformation study consider:

1. Developing more case studies. This approach enables analysts to place "indicator" data in the context of a narrative of market development, which makes them easier to understand and interpret. The case studies completed for this evaluation provided an abundance of detailed information regarding NYGB transactions, as well as stakeholder views of the clean energy market and their experience working with NYGB and other entities. This information provided valuable insights into the NYS clean energy market and the market for specific technologies. Furthermore, it is information that goes beyond the data that can be collected via a typical survey or the standard transaction documents.

2. Modifying the primary data collection approach to include more in-depth interviews with the financing community and developers.

3. Collecting data with a significantly longer lead time before results are due. The data collection for this Study occurred in November and December 2018, which coincided with participants' end-of-year transaction closings and regulatory filings. Response rates in future studies would likely improve if data collection occurs well before or after year end.

4. Re-examine and consolidate the indicators. Indicators such as changes in the number of clean energy finance transactions, their average size, and their dollar volume all seek to measure the same phenomenon and could potentially be combined. Since the NYGB portfolio was progressively built and indicators were identified as each transaction was developed, it would be appropriate to examine the full set of indicators at this time for their relevance across the portfolio, including their definitions and timeframes. Reducing the number of indicators will lend greater efficiency to future market evaluation studies.