

Matter Number 16-00681, In the Matter of the Clean Energy Fund  
Investment Plan

# Clean Energy Fund Investment Plan: On-Site Power Chapter

Portfolio: Market Development

**Submitted by:**

**The New York State Energy Research and Development Authority**

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Clean Energy Fund Investment Plan:  
On-Site Power Chapter

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## 23 On-Site Power

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On-site power production, also known as Distributed Generation (DG), involves the self-production of electricity at or near its point of use. New York State is experiencing great adoption of on-site power by building owners who value the economic savings, enhanced energy resiliency, and reduction in carbon emissions. NYSERDA will continue to support greater adoption of a wide variety of DG technologies, however several emerging on-site power technologies continue to have very low penetration in the marketplace and relatively high costs. More-effective approaches are needed to help these markets improve their value propositions, with the ultimate goal of discovering adequate revenues from marketplace sources.

The first initiative described in this chapter is Fuel Cells initiative. Fuel cells are a class of emerging technology which has struggled to reduce costs and monetize the values which differentiate it from other on-site power options available to customers, and as such, has been challenged to demonstrate a compelling value proposition which can grow the market to scale in New York in near term. As the New York State energy market transforms, it will be important for fuel cell stakeholders to understand how the capabilities of their projects could appeal to high-value customers, and how projects could be sited and configured so as to capitalize on the various components of market-based compensation that may be available, in order to develop successful business models.

Through the Fuel Cell initiative, NYSERDA will encourage the fuel cell stakeholders to re-engage in the New York marketplace, including pursuit of projects at high-value customers (such as those who value resiliency), and becoming/staying engaged in applicable policy working groups that are informing the design of market-based compensation mechanisms.

Program investments and activities will continue to be informed through ongoing research, technical analysis, and engagement with stakeholders and subject matter experts.

## 23.1 Fuel Cells

### 23.1.1 Overview

<p><b>Present Situation</b></p>	<ul style="list-style-type: none"> <li>• As of the end of 2016, there were 20 continuous-duty stationary power fuel cell systems operational in NYS, representing 10.5 MW.<sup>1</sup> NYSERDA is also supporting 29 continuous-duty stationary power fuel cell projects that are either currently under development or have more-recently begun operation, collectively representing 6.3 MW.</li> <li>• Since the expiration of the Renewable Portfolio Standard Customer-Sited Tier (RPS CST) Fuel Cell program in early 2016, engagement in the New York State marketplace by the fuel cell Original Equipment Manufacturers (OEMs) has dwindled.</li> <li>• To compete effectively with other on-site power options, the fuel cell market will need to improve the value proposition by reducing costs and configuring projects to capture various types of market-based compensation revenues (such as enrolling in demand response programs, siting projects at high-value customer sites or grid-constrained locations, etc.).</li> <li>• The market has indicated that ongoing work in New York State surrounding changes under Reforming the Energy Vision (REV) that are likely to provide new cash flow streams (often referred to as the value stack) could improve the value proposition for fuel cells when combined with a focus on high-value applications. The market has indicated that a concurrent fuel cell incentive program is crucial to encouraging the fuel cell stakeholders to engage in REV and associated working groups so as to drive value stack outcomes that include features which can be leveraged by fuel cells, and to focus on high-value applications within the New York marketplace.</li> </ul>
<p><b>Intervention Strategy</b></p>	<ul style="list-style-type: none"> <li>• NYSERDA's offering will provide financial support to assist facilities with projects to install on-site, stationary power, continuous-duty fuel cells to help reduce their energy expenses and greenhouse gas emissions, to relieve strain on the electric utility grid, and where applicable to enhance the resiliency of the host site.</li> <li>• This program will be an evolution of the previous RPS CST Fuel Cell program and will support continuous-duty stationary power fuel cells larger than 25 kW.</li> <li>• For a visual representation of this strategy, please reference the flow chart entitled "Logic Model: Fuel Cell Program," which can be found in Appendix A.</li> </ul>
<p><b>Goals</b></p>	<ul style="list-style-type: none"> <li>• Reduce the upfront costs to install and operate fuel cells</li> <li>• Attract fuel cell stakeholders to engage in REV and associated working groups</li> <li>• Drive fuel cell uptake configured for high-value applications.</li> </ul>
<p><b>State Energy Plan/Clean Energy Standard Link</b></p>	<ul style="list-style-type: none"> <li>• This initiative will contribute to the 2015 State Energy Plan goal to reduce greenhouse gas (GHG) emissions by 40% by providing on-site electric generation utilizing equipment that generates less emissions than standard technologies.</li> <li>• The 2015 State Energy Plan states that "REV will complement and further other resiliency efforts by promoting the development of clean, local energy resources that strengthen and improve the reliability of the grid." Continuous-duty stationary power fuel cells operate as a distributed generation resources, which can relieve stress on the grid and improve reliability.</li> </ul>

<sup>1</sup> US Department of Energy data at <https://doe.icfwebservices.com/chpdb/> as of 12/31/2016

### 23.1.2 Target Market Characterization

<b>Target Market Segment(s)</b>	The target market segment is fuel cell project developers seeking installation of systems in a grid-connected manner and operated continuous-duty. <sup>2</sup>
<b>Market Participants</b>	Market participants include: <ul style="list-style-type: none"> <li>• End use customers who will host fuel cell installations</li> <li>• Fuel cell project developers, including three OEMs of large stationary power fuel cell systems that have been active in the New York marketplace.</li> <li>• Franchisees who sell, install, and maintain an OEM’s fuel cell product.</li> </ul>
<b>Market Readiness</b>	<ul style="list-style-type: none"> <li>• All three of the active fuel cell OEMs have sales, installation and service channels and offer commercial products with commercial contracts.</li> <li>• Customers who choose to be early adopters of emerging technologies in order to get early exposure and with high-value needs have expressed an interest in assessing the applicability of fuel cells to their needs.</li> </ul>
<b>Customer Value</b>	<ul style="list-style-type: none"> <li>• Fuel cells allow end use customers to reduce their GHG emissions and energy costs, and where applicable to enhance the resiliency of the host site.</li> <li>• OEMs (and franchisee, as applicable) benefit in the form of increased sales revenues.</li> </ul>

### 23.1.3 Stakeholder/Market Engagement

<b>Stakeholder/Market Engagement</b>	<ul style="list-style-type: none"> <li>• NYSERDA has engaged in discussions with the three OEMs of large stationary power fuel cell systems that have been active in the New York marketplace. These discussions indicate that an incentive program would assist in creating sales opportunities, which would attract fuel cell OEMs to focus their attention on the New York marketplace, including engaging in REV and associated working groups.</li> <li>• NYSERDA also leveraged experiences gained through nearly a decade of running a fuel cell incentive program under the RPS CST which sunset in February 2016, acquiring on average slightly more than one megawatt-per-year throughout this decade duration. Although NYSERDA had previously invited RPS CST program participation of small continuous-duty stationary power fuel cells (modules size 25 kW and smaller), none materialized, therefore, NYSERDA believes it would be unnecessary to include small fuel cells in this initiative.</li> </ul>
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### 23.1.4 Theory of Change

<b>Market Barriers Addressed</b>	<ul style="list-style-type: none"> <li>• <b>OEM lack of focus on the NYS market.</b> OEMs focus on markets in other states, such as Connecticut and California, which they view as providing more sales opportunities. Additional financial support for projects can improve the value proposition and attract more participation in the NYS market, and especially can focus pursuit on high-value applications.</li> <li>• <b>Lack of compelling value proposition for fuel cells.</b> Energy cost savings provided by fuel cells frequently do not justify the high project costs for fuel cells. Market structure changes being pursued under REV may increase the</li> </ul>
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<sup>2</sup> The Fuel Cell incentive program is eligible to all sectors, including but not limited to residential, commercial, industrial, agricultural, institutional, educational, not-for-profit, and government-owned facilities.

	<p>revenues that a fuel cell project can accrue, such as when emphasizing locational value, and economics may improve when combined with a focus on high-value applications (such as data center customers who place a high value on reliability, or premium matching of a fuel cell to the load attributes of a prototypical customer).</p>
<b>Testable Hypotheses</b>	<ul style="list-style-type: none"> <li>• If fuel cell OEMs are provided with incentive funding, then they will continue to carry out sufficient marketplace activity in NYS long enough to allow for them to familiarize themselves with the new market compensation mechanisms that are emerging, and pivot to business models that improve the monetization of the benefits that fuel cells provide .</li> <li>• If marketplace activity continues, then business models that monetize the various benefits that fuel cells provide will emerge, and use-cases with high-value customers will be demonstrated.</li> </ul>
<b>Activities</b>	<p><b>Offer Open Enrollment Incentives</b></p> <ul style="list-style-type: none"> <li>• NYSERDA will provide an open enrollment incentive program for fuel cell projects. Incentives will be computed based on system nameplate capacity up to a maximum per eligible site where the fuel cell system will be installed.</li> </ul> <p><b>Maintain List of Eligible Equipment</b></p> <ul style="list-style-type: none"> <li>• A list of Eligible Equipment is maintained by NYSERDA on its website. Applicants will submit required documentation to be reviewed by NYSERDA to determine eligibility of the project.</li> </ul> <p><b>Provide Technical Review</b></p> <ul style="list-style-type: none"> <li>• Technical Review is conducted by NYSERDA staff. Installation is completed by firms and vendors that the customer retains on their own. Cost-sharing or incentives will be administered by NYSERDA after proof of successful completion of project milestones (installation milestones, and first annual operating performance milestone).</li> </ul>
<b>Key Milestones</b>	<p><u>Milestone 1 (2018)</u></p> <ul style="list-style-type: none"> <li>• Issue open enrollment solicitation.</li> </ul> <p><u>Milestone 2 (2018)</u></p> <ul style="list-style-type: none"> <li>• Contract with accepted open enrollment solicitation applicants as they apply thorough 2019.</li> </ul> <p><u>Milestone 3 (2018)</u></p> <ul style="list-style-type: none"> <li>• Confirm installation of equipment at site. This will start in 2018 and continue in 2019 based on timing of applications.</li> </ul> <p><u>Milestone 4 (2019)</u></p> <ul style="list-style-type: none"> <li>• Confirm first annual performance of fuel cell operation. This will start in 2019 and continue in 2020 based on timing of applications.</li> </ul>
<b>Goals Prior to Exit</b>	<ul style="list-style-type: none"> <li>• OEMs re-engaged in NYS fuel cell market.</li> <li>• Fuel cell project developers gain familiarity with market based compensation mechanisms.</li> </ul>

23.1.5 Relationship to Utility/REV

<b>Utility Role/ Coordination Points</b>	<ul style="list-style-type: none"> <li>• Fuel cells require coordination with electric utilities for electrical interconnection in accordance with the state’s Standardized Interconnection Requirements (NY-SIR), and where applicable coordination with the natural gas utility for acquiring a supply of fuel.</li> </ul>
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<b>Utility Interventions in Target Market</b>	<ul style="list-style-type: none"> <li>Utilities do not administer programs to incentivize installation of fuel cells. Utilities have offered market-based compensation for “non-wires solutions” (i.e., projects implemented by customers on the customer-side of the meter which, through the reduced load on the utility grid, deliver operational savings to the grid operator -- such projects may receive a payment from the utility pro-rated to the explicit benefit accruing to the utility) which may include fuel cells as eligible technologies, and it is foreseeable that this will continue.</li> </ul>
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### 23.1.6 Budgets & Expenditures

An annual commitment budget for all activities included in this chapter is shown in Table 1. The annual expenditure projection is included in Table 2. Budgets and expenditures do not include Administration, Evaluation, or Cost Recovery Fee; these elements are addressed in the Budget Accounting and Benefits chapter filing. The budget as presented in the Budget Accounting and Benefits Chapter will serve as the basis for any subsequent reallocation request. The additional level of detail presented within the table below is intended for informational purposes only.

**Table 1: Annual Market Development Budget Allocation – Commitment Basis**

<b>Commitment Budget</b>	<b>2018</b>	<b>2019</b>	<b>Total</b>
Direct Incentives and Services	\$7,500,000	\$7,500,000	\$15,000,000
Total	\$7,500,000	\$7,500,000	\$15,000,000

**Table 2: Annual Expenditures Projection**

<b>Expenditures</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>Total</b>
<b>Total</b>	10%	30%	50%	10%	100%

### 23.1.7 Progress and Performance Metrics

Table 3 provides program Activity/Output indicators representing measurable, quantifiable direct results of activities undertaken in the initiative. Outputs are a key way of regularly tracking progress, especially in the early stages of an initiative, before broader market changes are measurable. Outcome indicators can encompass near-term through longer-term changes in market conditions expected to result from the activities/outputs of an intervention. Outcome indicators will have a baseline value and progress will be measured periodically through Market Evaluation.

**Table 3. Initiative Specific Metrics**

<b>Indicators</b>		<b>Baseline (Before/Current)</b>	<b>2019 (Cumulative)</b>
Activity/Outputs	Number of fuel cell project incentives provided through program	0	27
Outcomes	Number of OEMs active in NYS	3	3

In addition to the above outcomes, NYSERDA will also assess the following broad outcomes:

- Progress toward monetization of the various benefits of fuel cells and the increase in familiarity with market compensation mechanisms.
- Demonstration of use-cases with high-value customers, such as those who place a premium on resiliency.

Benefits shown in Table 4 and Table 5 are direct, near term benefits associated with this initiative’s projects. These benefits will be quantified and reported on a quarterly basis and will be validated through later evaluation. Due to the nature of the activities, estimating energy savings impacts at this stage is difficult because the specific technologies that will be supported are not known. However, energy savings for projects supported by this initiative will be tracked and reported.

**Table 4. Direct Impacts**

Primary Metrics <sup>3</sup>		2018	2019	TOTAL
Energy Efficiency	MWh Annual	33,300	33,300	66,580
	MWh Lifetime	666,000	666,000	1,332,000
	MMBtu Annual			
	MMBtu Lifetime	-	-	-
	MW	4	4	8
Renewable Energy	MWh Annual	-	-	-
	MWh Lifetime	-	-	-
	MW	-	-	-
CO2e Emission Reduction (metric tons) Annual		3,750	3,750	7,502
CO2e Emission Reduction (metric tons) Lifetime		75,000	75,000	150,000
Customer Bill Savings Annual (\$ million)		\$3.00	\$3.00	\$5.99
Customer Bill Savings Lifetime (\$ million)		\$59.9	\$59.9	\$119.80
Private Investment (\$ million)		\$20.5	\$20.5	\$41

**Table 5. Annual Projected Initiative Participation**

	2018	2019	Total
Participants <sup>4</sup>	14	13	27

<sup>3</sup> Impacts are expressed on a commitment-year basis, and are incremental additions in each year. Assumes a 20-year measure life. Benefits are rounded to three significant figures. Totals may not sum due to rounding. Customer Bill Savings are calculated as direct energy bill savings realized by customers participating in NYSERDA’s programs. Energy Efficiency values represent electricity savings from use of the fuel cell; natural gas required to run the fuel cell (518,700 MMBTU cumulative annual and 10,370,000 MMBTU lifetime in Total) is netted out of the emission reduction and bill savings values shown in this table. Emission reductions are net, including both electricity savings which add to the emission benefits and additional MMBTU required to use the fuel cell which subtract from the benefits.

<sup>4</sup> Participants are end-use sites where fuel cells are installed.



NYSERDA does not anticipate achievement of indirect market effects associated with this initiative as it will not induce enough projects to scale-up the market sufficiently such that meaningful economy-of-scale manufacturing cost savings would materialize.

### 23.1.8 Fuel Neutrality

<b>Fuel Neutrality</b>	<ul style="list-style-type: none"> <li>This initiative is not being offered on a fuel neutral basis.</li> </ul>
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### 23.1.9 Performance Monitoring and Evaluation Plans

<p><b>Performance Monitoring &amp; Evaluation Plan</b></p>	<p>NYSERDA’s approach to monitoring and assessing the effectiveness of the initiative and overall market development is described below.</p> <p><b><u>Test-Measure-Adjust Strategy</u></b></p> <ul style="list-style-type: none"> <li>Collect and analyze fuel cell project data and report on progress of the initiative by comparing progress against identified goals on a regular basis (i.e., quarterly, bi-annually).</li> <li>The design of the fuel cell initiative will be tested to gauge the target population’s reaction to the strategy. This information will be used to help inform decisions about how to allocate time and resources within the initiative and to confirm market interest.</li> </ul> <p><b><u>Fuel Cell Strategy M&amp;V</u></b></p> <ul style="list-style-type: none"> <li>Site inspections will be conducted for each project supported by the initiative to confirm reported system characteristics (e.g., nameplate capacity) and ensure proper system installation.</li> <li>Each system will be enabled to provide generation data to NYSERDA, which will be posted on NYSERDA’s DG Integrated Data System website.</li> </ul> <p><b><u>Market Evaluation</u></b></p> <ul style="list-style-type: none"> <li>Market evaluation will draw on the logic model and will address key indicators such as sales of fuel cell systems; changes in familiarity regarding methods that monetize fuel cell benefits; and the demonstration of high-value use cases.</li> <li>As appropriate, the market evaluation will leverage sector-level market studies as well as publicly and commercially available data to inform the tracking of key market indicators.</li> </ul> <p><b><u>Impact Evaluation/Field Verification</u></b></p> <ul style="list-style-type: none"> <li>Evaluation M&amp;V (EM&amp;V) of direct savings will be carried out in a phased approach that begins with desk review of project-level data collected during site visits and posted on NYSERDA’s DG Integrated Data System website. The initial focus will be on larger projects and consideration will be given to the analysis of small projects as well, if deemed appropriate.</li> <li>If additional EM&amp;V activity is warranted, it will be conducted according to the International Performance Measurement &amp; Verification Protocol (IPMVP) method(s) most appropriate given the systems promoted by this initiative. Additional activity will likely occur for projects with EM&amp;V results that differ significantly from anticipated impacts, or upon request from program staff to maximize learning.</li> <li>Data from Field Verification/Impact Evaluation can be used to help lend confidence in the market, especially among other end users.</li> </ul>
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# Appendix A – Logic Models

## LOGIC MODEL: Fuel Cell Program

