

Green Energy Fund Review and Recommendations

**PREPARED FOR
DELAWARE DEPARTMENT OF NATURAL
RESOURCES AND ENVIRONMENTAL CONTROL**

**PREPARED BY
VERMONT ENERGY INVESTMENT CORPORATION**

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**Vermont
Energy Investment
Corporation**

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veic.org

Tel: (802) 658-6060
Toll-free: (800) 639-6069

VEIC Headquarters:
128 Lakeside Avenue, Suite 401
Burlington, VT USA 05401

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- **Dale Davis**, President, CMI Solar Electric
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- **Erick Karlen**, Sr. Regulatory Specialist, Sungevity
- **Daniel LaCivita**, Manager - Training and Compliance, Dassault Aircraft Services
- **Scott Lynch**, Energy Services Manager, DEMEC
- **Finn McCabe**, Regulatory Affairs, Flexera
- **Glenn A. Moore**, Vice President, Delmarva Power & Light
- **Thomas Noyes**, Principal Planner for Utility Policy, Division of Energy and Climate, Delaware Department of Natural Resources and Environmental Control
- **Russell Pfaller**, Installation Manager, Green Street Solar
- **Victor Poon**, Finance Analyst, Sungevity
- **Kevin Quilliam**, CEO, InClima
- **Suzanne Sebastian**, Green Energy Program Manager, Division of Energy and Climate, Delaware Department of Natural Resources and Environment Control
- **Lauren Siler**, InClima
- **David Stokes**, President, Marketing and Sales, Liberty Services Company
- **Marta Tomic**, Solar Clean Energy Program Manager, Maryland Energy Administration
- **Rob Underwood**, Energy Programs Administrator, Division of Energy and Climate, Delaware Department of Natural Resources and Environment Control
- **Robert Wevodau**, Technical Services, KW Solar Solutions
- **Dale Wolf**, President, KW Solar Solutions

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Introduction

The Green Energy Fund (GEF) provides grant incentives for qualifying renewable energy systems, including solar photovoltaic (PV), solar water heating, wind, and geothermal heat pumps installed in Delmarva Power and Light's Delaware service territory. Delmarva Power and Light (DPL) ratepayers fund the incentives, and the Delaware Department of Natural Resources and Environmental Control (DNREC) administers the Fund. The Delaware Energy Act of 1999 established the GEF. The program has funded more than \$30 million of renewable energy projects since 1999, resulting in more than 1,400 new renewable energy projects in the state.

Over the last few years, the GEF funding available for residential and non-residential incentives has averaged about \$2.6 million per year. A monthly allocation from the GEF pays direct incentives for completed solar projects. This funding is split 60% to residential projects and 40% to non-residential projects. If there is more demand from completed projects than the monthly funds can cover, the projects are put in a delayed-payment queue until enough funds are available to pay the incentives. Demand for funding from the program has increased over time. Currently a substantial backlog exists for residential projects that have applied for solar PV incentives. This backlog is a result of an increase in the number of applications submitted right before incentives and maximum grant levels were changed, effective July 1, 2014. Additionally, there continues to be a steady increase in the number of applications since July 1, 2014, resulting in a delayed-payment queue of more than 12 months for the DPL Residential Rebate Program.

In January 2015, DNREC commissioned the Vermont Energy Investment Corporation (VEIC) to review and provide program design and implementation recommendations for the GEF. DNREC requested the review because of concern that program participation rates might deplete the funding and result in a larger backlog of applications awaiting approval. In addition, program staff noted a large upswing in leased systems, including those using power purchase agreements (PPAs). In requesting this review, DNREC sought to ensure that customers fully understand the implications of leasing, rather than owning, PV systems supported by the GEF.

DNREC program staff seeks to ensure sustained, orderly development of the solar market in Delaware via financial incentives. An important goal of such programs is to establish incentives at a level that prompts customers to make an investment in a new, renewable energy system that they would not otherwise have made, had it not been for the incentive. The primary challenge to this approach is to optimize the size of the incentive, given the total program budget. The objective of the approach is to serve the largest possible number of customers at incentive levels that drive market demand. Failure to meet the objective can lead to unpredictable program starts and stops if demand for funds exceeds the amount available in the incentive pool.

It is not uncommon for incentive programs such as the GEF to gradually and consistently reduce incentive levels as markets mature for new renewable energy projects. It is also not uncommon to put a hold on such programs if demand for incentives exceeds the available funding.

This report provides an analysis of the GEF, an analysis of the customer economics, key findings from the review, and recommendations for program modifications.

Purpose of the Study

Given the current activity levels for the GEF combined with the yet-to-be-paid backlog projects submitted prior to July 1, 2014, the purpose of the study is to assess current solar PV incentive levels as well as eligibility requirements and suggest modifications, as appropriate, given the current scale and maturity of the market in Delaware.

To achieve the project purpose, the following activities were completed:

- The GEF program history and the existing program design and implementation approach were reviewed, assessed, and compared to surrounding states (New Jersey and Maryland).
- An analysis of the economics for solar PV systems was conducted by comparing the customer economics for leased and owned systems to the PPA or leasing company economics for Residential PPAs and leases with current and changed attributes. Changing the attributes in the financial model, such as grant incentive levels and the Investment Tax Credit (ITC) helped determine the financial impacts to customers and project owners of any changes to the GEF.
- Recommended changes, as appropriate, to ensure sustained, orderly market development for solar PV in Delaware.

Throughout the process, input from the well-developed network of solar stakeholders, including solar equipment installers and leasing companies currently serving the Delaware market, was solicited. This helped ensure industry input and involvement in advance of potential program changes.

Analysis of the GEF

Market Comparisons

The detailed research and analysis prepared for this report focuses on Delaware in comparison to New Jersey and Maryland. These states were chosen since they are adjacent to Delaware, have experienced similar market growth, and many Delaware solar companies do business in those states as well. Delaware is a smaller state than its neighbors, therefore having lower overall solar capacity. However, compared to other states in the Mid-Atlantic and Southern New England, as shown in **Table 1**, Delaware is positioned just below the two market leaders (New Jersey and Massachusetts) in per –capita capacity, but well above Maryland and Pennsylvania.

Table 1: 2013 Comparison of Solar Industries in the Mid-Atlantic and Southern New England Regions¹

	Regional Market Leaders			Other States in the Region				
	NJ	MA	DE	MD	PA	DC	NY	CT
Number of Solar Companies	488	346	44	151	457	106	48	125
Number of Contractors/installers	294	133	27	79	267	7	177	44
MW of solar installed in 2013	236	237	9	29	38	2	69	37
MW of solar currently installed as of 2013	1369	678	59	186	240	9	338	89
State Population (million)	8.9	6.7	0.9	6.0	12.8	0.7	19.7	3.6
MW of solar installed <i>per million residents</i> in 2013	26.4	35.4	9.6	4.9	3.0	2.9	3.5	10.3
MW of solar currently installed <i>per million residents</i> cumulative through 2013	153.2	101.2	63.1	31.1	18.8	12.9	17.2	24.7
Million \$ invested in solar in 2013	\$693	\$789	\$23	\$113	\$144	\$7	\$343	\$143
\$ invested in solar PV <i>per resident</i> in 2013*	\$78	\$118	\$25	\$19	\$11	\$10	\$17	\$40
System price drop last year	N/A	10%	8%	15%	N/A	N/A	14%	14%

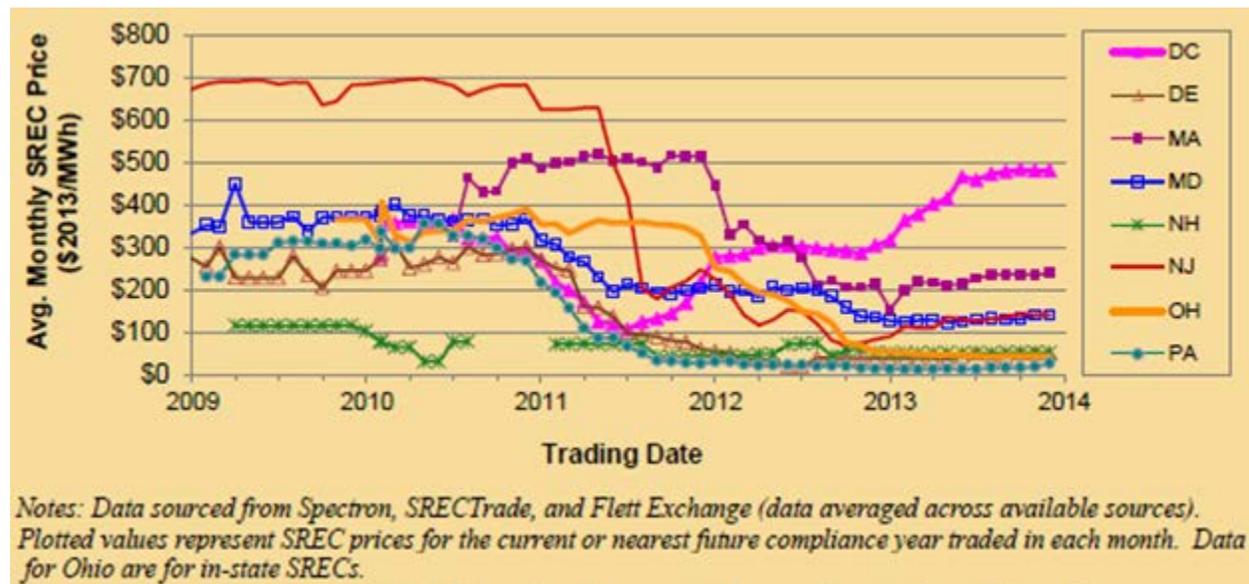
¹ Data extracted from the SEIA website – 12/30/14

**Meant only as a weighted comparison between states; does not equal what each resident invested, as commercial and industrial customers are not accounted for.*

Many of the states in this region have a Renewable Portfolio Standard (RPS), requiring a certain percentage of electricity to be produced from renewable energy sources. States often have different requirements regarding the type of renewable energy that can be considered to satisfy the RPS. For example, some states consider small hydro while others do not. Some allow for large industrial users to opt out of meeting the standard.

Many states also have a solar carve-out which requires electricity suppliers to buy a portion of their electricity from solar generators in the state. Each megawatt-hour of solar electricity produced by a solar PV system -- and in some states a solar hot water system -- can be assigned a Solar Renewable Energy Certificate (SREC) and sold on the SREC market. For the SREC market, the price of solar generated electricity is generally set by the market. Electricity generators (or in some cases, distributors) are required to buy renewable energy up to a set requirement or pay a fine if they fall short (the Alternative Compliance Payment or ACP). Some states with an SREC market have moved away from offering incentives altogether (especially for commercial customers) and rely on SRECs to provide financial incentives. The price of SRECs in this region has been volatile at times. However, since 2011-2012, prices have declined and have become more stable in most states with a SREC market.

Figure 1: SREC prices in states with an SREC market²



² 2014 LBNL Tracking the Sun VII Report

Key Policies

Delaware

The Renewable Portfolio Standards (RPS) established in 2005 by the Renewable Energy Portfolio Standards Act³ requires electricity suppliers to supply a percentage of their total annual electricity sales from renewable energy resources. [Title 26](#) of the Delaware Code provides the exact requirements for the RPS, which mandates 25% renewable energy by 2025-2026 with a 3.5% solar carve-out that includes an incremental increase from 1% in 2007 to 10% by 2019. Eligible renewable energy resources for Renewable Energy Credits (RECs) include solar electric power, wind energy, geothermal energy, ocean energy, fuel cells, small hydropower, landfill gas and sustainable biomass. Additionally, on July 7, 2011, Governor Jack Markell signed into law amendments to the RPS Act which added Delaware-manufactured fuel cells to the RPS and allowed energy output from fuel cells to be considered an eligible renewable energy resource.⁴

The State of Delaware Green Energy Program (GEP) was enacted by [House Bill 10](#) in 1999 (the Electric Utility Restructuring Act) as part of the deregulation of Delaware's electric utilities. The Act created an environmental incentive fund (26 Del. C. §1014) to use for efficiency and conservation in Delmarva Power and Light's service territory. The Delaware Economic Development Office administered the fund from 1999 until the [Delaware Energy Act](#) in 2003 (29 Del. C. § 8051 et seq.), which established the Delaware Energy Office (DEO) in the Office of the Secretary of the Delaware Department of Natural Resources and Environmental Control (DNREC). The Act changed the environmental incentive fund to the Green Energy Fund (GEF) and shifted its administration to the DEO. The GEF program is limited to Delmarva Power and Light (DPL) customers, because under House Bill 10 in 1999, only DPL customers were required to contribute to the fund through a charge on their electric bill. This fund was established through the Delaware Energy Act in 1999. The yearly GEF available for incentives is approximately \$2.6 million⁵ (including funds allocated to the other renewables) as indicated in **Table 2**. By regulation, 60% of GEF funds are reserved for residential projects, and 40% for non-residential projects.⁶ From 1999 to 2005 the only Green Energy Program in the State of Delaware was for DPL customers. More recently the Delaware Municipal Electrical Corporation and Delaware Electric Cooperative established renewable energy programs of their own. However, the majority of the solar capacity installed is within the DPL service territory.

³ 143rd General Assembly, Senate Bill No. 74 and amendments

⁴ Delaware administrative code – Title 26 Chapter 1, Subchapter III-A. Renewable Energy Portfolio Standards

⁵ DPL deposit breakdown as supplied by DNREC staff

⁶ Delaware code title 29 Chapter 80 Department of Natural Resources and Environmental Control Subchapter II. The Delaware Energy Act - <http://delcode.delaware.gov/title29/c080/sc02/index.shtml>

Table 2: Annual Delmarva Power and Light Deposits to the GEF

Funding Year	Residential	Non-Residential	Total
July 2012 - June 2013	\$1,572,119.05	\$1,122,110.80	\$2,694,229.85
July 2013 - June 2014	\$1,588,556.72	\$1,059,037.80	\$2,647,594.52
July 2014 - February 2015* (partial year)	\$1,173,025.82	\$782,017.20	\$1,955,043.02

Source: DPL deposit breakdown as supplied by DNREC staff

***Partial year missing March, April and May 2015 as deposits have not been received.**

Maryland

Maryland's RPS was enacted in May 2004 and has been revised numerous times since then. The RPS is designed with tiers, each tier allowing different renewable types. The solar carve-out, like most other renewables, is part of Tier 1. Tier 2 includes hydroelectric power other than pump-storage generation and is designed to sunset after 2018. Each electricity supplier must submit a report to the Public Service Commission (PSC) annually that demonstrates compliance with the RPS.

The solar carve-out began at 0.005% of retail sales in 2008 and increases incrementally each year to reach 2% by 2020. The solar carve-out is projected to result in the development of more than 1,250 MW of solar capacity by 2020.

An electricity supplier that fails to meet the RPS must pay an alternative compliance payment (ACP) into the Maryland Strategic Energy Investment Fund (SEIF). The ACP fee schedule was amended by S.B. 277 in May 2010. Compliance fees paid into the SEIF, which is administered by the Maryland Energy Administration, are used to fund grant and loan programs for Tier 1 renewable energy resources. Compliance fees for the solar obligation may be used only to support new solar resources in the state. The SEIF replaces the Maryland Renewable Energy Fund, which was repealed by H.B. 368 in 2008. The PSC is required to submit annual reports to the state legislature detailing utility compliance with the standard.⁷ The solar programs are administered by the Maryland Energy Administration and cover all ratepayers in Maryland.

New Jersey

New Jersey's RPS was established in 1999 through the Electric Discount and Energy Competition Act, P.L.1999, c.23. Through the years it has been amended to be one of the more aggressive in the United States. It requires each supplier/provider serving retail customers in the state to procure 22.5% of the electricity it sells in New Jersey from qualifying renewables by 2021 ("Energy Year" 2021 runs from June 2020 – May 2021). The solar carve-out requires suppliers and providers to procure at least 4.1% of sales from qualifying solar electric generation

⁷ DSIRE accessed 1/20/2015

facilities located in New Jersey by Energy Year (EY) 2028.⁸

The solar carve-out was originally stated as a percentage-based target but in January 2010, new legislation ([A.B. 3520](#)) adjusted the solar portion of the standard to be stated in terms of gigawatt-hours (GWh), resulting in a revised schedule requiring 17.88% from Class I and 2.5% from Class II renewables by EY 2021 (together 20.38% by EY 2021), and an additional 5,316 GWh from solar-electric facilities by EY 2026. In 2012 the solar compliance schedule reverted back to a percentage-based target of 4.1% by EY 2028. The change was part of [S1925](#) also known as the Solar Act of 2012. This Act included many changes to the legislation to reduce the volatility of the New Jersey solar market with the availability of more SREC in the marketplace than needed to achieve the solar carve-out goal. It additionally increased the RPS requirements beginning in EY 2014 to account for the substantial amount of solar capacity installed in the state. The solar programs are administered by the Office of Clean Energy and cover all the ratepayers in New Jersey.

Net Metering, Deed Restrictions, and Tax Credits

Delaware

Delaware's net metering law applies to all utilities in the state. It allows any net excess generation produced by a solar system to be applied to the next electric bill as a credit at the full retail rate. If a surplus is run for a 12-month period, the customer may elect to have the electric company pay them for the surplus, at the full retail rate, or the customer can keep the credit rolling over onto their electric bill indefinitely.

Net metering was expanded significantly in July 2007 to all customer classes, and by addressing the ownership of SRECs and increasing the prior system limit of 25 kW. The net metering law was again amended in 2009 to extend net metering to farm service customers on residential rates; to remove a requirement to forfeit net excess generation after 12 months; and to expand the aggregate program capacity limit from 1% of the Electric Supplier's aggregated customer monthly peak demand to 5%.⁹

In 2009, legislation was passed that prohibits deed restrictions that had previously restricted some homeowners (especially those in condominium associations) from installing solar systems. The legislation does not apply retroactively. Any existing deed restriction is grandfathered in existing subdivisions.¹⁰

There are no solar tax credits, and no property tax exemption for solar systems in Delaware. Delaware has no sales tax, so sales tax exemptions do not apply in the state.

⁸ DSIRE accessed 1/20/2015

⁹ DSIRE, accessed 1/7/2015

¹⁰ <http://www.flexera.net/node/134>

Maryland

Maryland's net metering law has been expanded several times since it was originally enacted in 1997. The rules apply to all utilities in the state.

Net metering is available statewide until the aggregate capacity of all net metered systems reaches 1,500 MW. The aggregate limit on net metering was 34.7 MW prior to the 2007 amendments.

System size for net metered solar is limited to 2 MW and is intended to offset all or a portion of a customer's on-site energy requirements. Systems are limited in size to that needed to meet 200% of the customer's baseline annual electricity use. Net excess generation (NEG) is generally carried over as a kilowatt-hour credit (i.e., at the retail rate) for 12 months. Compensation for any NEG remaining in a customer's account after a 12-month period ending in April of each year is paid to the customer at the commodity energy supply rate.¹¹

The Clean Energy Incentive Tax Credit, enacted in 2006, offers Marylanders a state income tax credit for electricity generated by qualified resources of 0.85 cents per kilowatt-hour, and 0.50 cents per kilowatt-hour for electricity generated from co-firing a qualified resource with coal. These credits can be claimed over a period of five years. Annual tax credits cannot exceed one-fifth of the initial credit certificate issued by the Maryland Energy Administration. This credit is available to individuals and corporations that build and generate electricity from qualified resources operational on or after January 1, 2006, but before January 1, 2016.

The Clean Energy Incentive Tax Credit offers an individual or corporation a state income tax credit for electricity generated from solar PV of 0.85 cents per kilowatt-hour for a five-year period. This credit is available for systems that are operational on or after January 1, 2006, but before January 1, 2016. In order to receive these credits, eligible participants must apply for an Initial Credit Certificate with the MEA. These are issued on a first-come, first-served basis. Total Initial Credit Certificates will not exceed \$25,000,000 by 2016, with each Initial Credit Certificate not exceeding \$2,500,000 and no less than \$1,000 to any eligible taxpayer.¹²

Maryland lawmakers enacted a state (but not local) property tax exemption for solar panels.¹³ Solar panels have been exempt from sales tax for residential customers since July 2011.¹⁴

New Jersey

New Jersey's net metering law applies to only the utilities regulated by the Board of Public Utilities (BPU). This enables behind the meter customers to get full retail credit on their utility bill for each kilowatt-hour of electricity produced in excess of their demand. The utility tracks the difference between usage and production for each customer. The customer can draw on their

¹¹ DSIRE, accessed 1/7/2015

¹² MEA website – 2/26/14 - <http://energy.maryland.gov/Business/CleanEnergyTaxCredit.html>

¹³ DSIRE accessed 12/31/2014

¹⁴ DSIRE accessed 12/31/2014

credits to pay for usage during periods when their demand exceeds their production. At year-end, any balance in the customer account is paid to the customer at the wholesale price for electricity. The regulations also state that the PV system cannot be sized to exceed the customer's historical usage.

New Jersey offers a full exemption from the state's sales tax (currently 7%) for all solar energy equipment.¹⁵ This exemption is available to all taxpayers. According to S&U-6 (Sales Tax Exemption Administration), the exemption includes all solar energy "devices or systems specifically approved by the Board of Public Utilities, Division of Energy and designed to provide heating or cooling or electrical or mechanical power by converting solar energy to some other usable energy source, including devices for storing solar-generated energy." Additionally New Jersey enacted legislation exempting solar systems from local property taxes if the system is used to meet on-site electricity, heating, cooling, or general energy needs.¹⁶

Program History and Demographics

Delaware

Population growth in Delaware from 2010-2013 has been 3.1% (higher than the national average of 2.4%),¹⁷ resulting in increased demand for energy services. To address the issues of growth in demand, rate increases, and climate change, among others, the State of Delaware has used the GEF to offer renewable energy rebates. The State Energy Plan has provided a framework to justify funding for renewable energy incentive programs. "Bright Ideas for Delaware's Energy Future", Delaware's first energy planning process in more than 20 years, was completed in 2003. The "Ensuring Delaware's Energy Future" report was issued in 2006. In 2009, the Delaware Energy Plan Council Report came out with statewide plans for the 2009-2014 timeframe, including recommendations for renewable energy programs.

The incentive level for the solar grant incentive program funded by the GEF has been changed several times since 2002 (**Table 3**) to ensure sustainability of program funds and better reflect changing market costs.

In 2010, incentives were changed to a per-watt incentive to be consistent across the board for all installing contractors, based on system size rather than system cost. This also eliminated the risk of incenting any expenses that may not have been associated with the actual solar system installation.

In 2012, a change was made in the regulations allowing for an easier adjustment of incentive levels to adapt to rapid market changes.¹⁸ Under the change, the incentive level was to be

¹⁵ http://www.njleg.state.nj.us/2006/Bills/A5000/4643_I1.HTM

¹⁶ <http://www.seia.org/policy/finance-tax/solar-tax-exemptions>

¹⁷ <http://quickfacts.census.gov/qfd/states/10000.html>

¹⁸ Department of Natural Resources and Environmental Control, Office of the Secretary, Statutory Authority: 7 Delaware Code, Chapter 60 (7 Del.C. Ch. 60), 7 DE Admin. Code 104, PROPOSED, REGISTER NOTICE, SAN 2012-04

announced on the DNREC website, rather than written in the regulation.¹⁹ The program is currently structured with different incentive levels for the first 5 kW, and the remaining 45 kW. As larger projects generally have overall lower installation costs, tiering the grant in this manner allows larger projects to get proportionally lower rebates than smaller projects.

If funds are oversubscribed, a delayed-payment queue is created. Applicants in the queue are paid in the order in which the last documents are received to finalize their grant incentive applications. There are currently no extra funds available to eliminate the backlog. However, under American Recovery and Reinvestment Act (ARRA) funding, the program was modified to allow additional energy efficiency measures to be installed by applicants at their expense (\$500 minimum energy efficiency investment). These were fast-tracked and removed from the payment queue up to the amount of ARRA funds infused into the program. **Within the administrative code, there is an unexpended funds provision which states that if funds are not expended during a particular year, those funds shall be considered part of the GEF and are available for allocation and expenditure in subsequent years. Provided the Controller General approves, the annual funds collected and unused during a fiscal year that have been apportioned to the non-residential sector in the Green Energy Endowment Program may be moved into the residential sector in following years to allow the Energy Office to satisfy application queues, should they develop.**²⁰

Table 3: Green Energy Fund Incentive Structure 2002-2015

Start Date	End Date	Market	Incentive per Watt			System size restriction	Maximum incentive
			0-5kW	5-10kW	10-50kW		
7/1/2004 or earlier	5/12/2009	residential	50% installed costs*			no restrictions	\$22,500
7/1/2004 or earlier	5/11/2009	non-residential	50% installed costs*			no restrictions	\$250,000
5/12/2009	12/10/2010	residential	25% installed costs*			no restrictions	\$31,500
5/12/2009	12/10/2010	non-residential	25% installed costs*			no restrictions	\$250,000
5/12/2009	12/10/2010	non-profit	35% installed costs*			no restrictions	\$250,000
12/10/2010	7/1/2014	residential	\$1.25	\$0.75	\$0.35	<50 kW	\$15,000
12/10/2010	7/1/2014	non-residential	\$1.25	\$0.75	\$0.35	<50 kW	\$24,000

¹⁹ Department of Natural Resources and Environmental Control, Office of the Secretary, Statutory Authority: 7 Delaware Code, Chapter 60 (7 Del.C. Ch. 60), 7 DE Admin. Code 104, PROPOSED, REGISTER NOTICE, SAN 2012-04

²⁰ Delaware code title 29 Chapter 80 Department of Natural Resources and Environmental Control Subchapter II. The Delaware Energy Act - <http://delcode.delaware.gov/title29/c080/sc02/index.shtml>

12/10/2010	7/1/2014	non-profit	\$2.55	\$1.50	\$0.70	<50 kW	\$48,000
7/1/2014	TBD	residential	\$0.85	\$0.25	\$0.25	<50 kW	\$15,000
7/1/2014	TBD	non-residential	\$0.85	\$0.25	\$0.25	<50 kW	\$24,000
7/1/2014	TBD	non-profit	\$1.75	\$1.00	\$1.00	<50 kW	\$48,000

Source: GEF website ([www. http://www.dnrec.delaware.gov/energy/services/GreenEnergy](http://www.dnrec.delaware.gov/energy/services/GreenEnergy))

* System cost had to be less or equal to \$12/W.

Maryland

The Energy Programs Division originated as Renewable Energy, and was re-formed as Clean Energy in 2008. In 2014, it adopted its present name. Included energy programs are Commercial and Industrial Energy Efficiency; Community Programs; Farm Audits and Incentives; Residential and Commercial Clean Energy Grants; Solar and Wind Grants Programs; State Government Energy Efficiency and Energy Assurance; and Transportation Bio-Fuels and Clean Production Programs.

As of July 1, 2012, the Maryland Energy Administration recalculated the clean energy grant incentives based on several factors including available funds, economies of scale, a desire for more equitable distribution of funds, the cost of clean energy technologies, capacity factors, potential annual production, and data analysis from past clean energy awards.²¹

On July 20, 2012, The Clean Energy Grant Program (CEGP) began operating under new program funding authority — the [Strategic Energy Investment Fund](#) — which affects how clean energy technologies are taxed. As of July 2012, all clean energy grants may now be taxable at the federal and state level — a change from previous funding authority which exempted clean energy grants from being considered taxable income at the state level.²²

MEA’s clean energy grant programs are funded through several different sources, such as federal stimulus funding (ARRA, which was available through 2011), the Strategic Energy Investment Fund (SEIF), and from the ACP contributed by electricity generators that do not meet the RPS.²³ The Strategic Energy Investment Act of 2008 requires that 10.5% of the Fund be allocated annually to Clean Energy & Climate Change Programs, Outreach & Education.²⁴

When the SEIF was created, MEA used its funds to supplement existing grant programs, as their current funding did not meet demand. The SEIF funds were to be used to serve the people then on the waiting list, and any additional applications received by November 30, 2009. For solar and wind, the grant amount was \$2,500 per kW for up to 4 kW with a maximum amount of

²¹ <http://energy.maryland.gov/Business/cleanenergygrants/index.html#goals>

²² <http://energy.maryland.gov/Business/cleanenergygrants/index.html#goals>

²³ <http://energy.maryland.gov/energy101/index.html>

²⁴ http://energy.maryland.gov/documents/MEA_FY10.pdf, Using the Strategic Energy Investment Fund, Maryland’s Energy Future, Keeping bills down, lights on & climate healthy

\$10,000. When the Federal Government lifted the \$2,000 cap from the solar Investment Tax Credit that began January 1, 2009, MEA anticipated increased applications for its solar grant program in the next calendar year and adjusted the incentive level correspondingly.²⁵ **Table 4** summarizes major incentive milestones for the Maryland Energy Administration programs.

Table 4: Maryland Solar Incentive Levels – 2005 to present

Program name	Fiscal Year	Incentive Amount	System size restriction
Residential Clean Energy Grant	2005 - 2007	Lesser of \$3,000 or 20% of the total installed cost	
Commercial Clean Energy Grant- Commercial	2009 - 2010	Lesser of \$5,000 or 20% of total installed costs	1 - 200 kW
Residential Clean Energy Grant	2009 – 2010	\$2,500/kW up to \$10,000	1 - 20 kW
Commercial Clean Energy Grant- Small Commercial	2010 - 2011	\$0.50/W	< 100 kW
Commercial Clean Energy Grant- Large Commercial	2010 - 2011	\$0.25/W	100 – 200 kW
Residential Clean Energy Grant	2010 - 2011	\$1.25/W up to 4000 W \$1.0/W 4001 – 8000 W \$0.25/W 8001 – 20,000 W	1 - 20 kW
Commercial Clean Energy Grant- Small Commercial	2012 - 2015	\$0.06/W	<100 kW
Commercial Clean Energy Grant- Large Commercial	2012 - 2015	\$0.03/W	100 - 200 kW
Residential Clean Energy Grant	2012 -2015	\$1000 flat award	1-20 kW

Source: Content assistance from Marta Tomic, Solar Clean Energy Program Manager at Maryland Energy Administration reasonable ascertainable from available public records, but may not have 100% accuracy.

New Jersey

The solar incentive programs were launched in April 2001. New Jersey’s regulated utilities coordinated the administration of a statewide Customer-sited Clean Energy Generation program (CSCG). The focus for the solar component was on roof-top customer sited systems for residential and non-residential customers. The program offered direct financial incentives to reduce the cost of systems, including installation and interconnection costs. Incentives were to decrease over time as the number of MW installed increased. The utilities managed the program until April 2003 when the Board of Public Utilities’ (BPU) Office of Clean Energy (OCE) staff took over the program and renamed the program the Customer On-Site Renewable Energy (CORE) program. The rebate structure did not change during the first two years of the CORE

²⁵ http://energy.maryland.gov/documents/MEA_FY10.pdf, Using the Strategic Energy Investment Fund, Maryland’s Energy Future, Keeping bills down, lights on & climate healthy

program because the capacity blocks were not met. The OCE managed the solar incentive program until January 2007, when an outside program administration firm was hired to manage all the renewable energy incentive programs for the OCE.

The rebate structure and program requirements stayed the same from April 2001 until July 1, 2005. To encourage greater price competition among installers, the new rebate calculation methodology no longer employed a percentage of total system costs; caps and rebates were calculated solely from kW installed. In late 2005 and early 2006, the pace of submission of new solar applications requesting rebates increased significantly. During this time the BPU Board took a number of steps, including reducing the rebate levels, imposing size limits on residential systems and tightening program participation standards to help manage the program to remain within the four-year renewable funding level set by the Board.²⁶ The solar market in New Jersey was seeing double-digit growth and the development of a large queue of projects requesting approval without available funding. As of November 30, 2007, there were more than \$120.5 million in incentive applications in queue after all the remaining funding was committed.²⁷ The final 2008 budget was increased to enable the release of all projects in the queue but the CORE program ceased accepting applications for all private sector projects effective December 20, 2007 and all public sector projects effective April 1, 2008.²⁸

Additionally, the BPU Board approved a pilot program allowing New Jersey customer-generators that develop solar energy systems to participate in the Solar Renewable Energy Certificate (SREC) market without participating in the CORE incentive program. This allowed for an expedited means to obtain SRECs for projects. Applications were accepted for this program from July 2007 to January 2009 when this pilot was renamed the SREC Registration Program. It is still active today.

Solar incentive applications were again accepted under a new program, the Renewable Energy Incentive Program (REIP), on February 3, 2009 with new rebate levels, program requirements and system size caps. Extra incentives were awarded for completing energy efficiency audits and for purchasing panels, inverters or racking systems from New Jersey-based manufacturers. The residential PPAs started to be treated as commercial entities and received the rebate amounts for non-residential customers. Systems larger than 50kW were no longer eligible for rebates. This program identified capacity blocks of 10MW and 20MW for residential projects. Once the capacity block was met, the rebate would be reduced by a predetermined amount. Even with much lower rebates, projects continued to be built. By December 2009, just under 60MW of solar capacity was placed into service; more than double that of 2008. The REIP program continued in 2010, but in addition to capacity blocks there were also reduced rebates, reduced levels of participation and three funding cycles for the year. This helped keep the flow of

²⁶ Board Order – 12/23/04 – docket EX040276

²⁷ Paraphrased from BPU Board order – Docket number EO07100773 – “Request to Suspend the acceptance and processing of new solar applications in the NJ CORE incentive program

²⁸ Paraphrased from BPU Board order – Docket number EO07100773 – “Request to Suspend the acceptance and processing of new solar applications in the NJ CORE incentive program

applications spread out throughout the year. Additionally, during Funding Cycles 1 and 2, installing the energy efficiency measures identified during the energy audit became a requirement for receiving a rebate. During Funding Cycles 2 and 3, residential PPAs could no longer participate. In Funding Cycle 3, neither could any residential systems greater than 10kW or any non-residential systems greater than 30kW. These projects all participated only in the SREC Registration Program (SRP). The incentive program ended on December 31, 2010. The SRP continues today, with active participation helping the New Jersey solar market remain third in the country for cumulative solar capacity installed.²⁹ Legislation such as the [Solar Act of 2012](#) has helped manage the number of solar installations coming from grid supply projects (solar farms) to help ensure that financial viability exists for behind the meter projects.³⁰ **Table 5** summaries major rebate milestones for New Jersey’s Clean Energy Program (NJCEP).

Table 5: NJCEP Incentives 2003 - 2010

Start Date	End Date	Market	Incentive per Watt					System size restriction	Maximum incentive
			Up to 10kW	>10-50kW	>50-100 kW	>100-500 kW	>500 – 750 kW		
4/1/03	6/24/05	Res, Non-Res	\$5.00	\$4.00	\$4.00	\$3.75		2MW	<=10kW – 70% of total costs, >10kW – 60% total costs
7/1/05	3/15/06	Res, Non-Res	\$4.95	\$3.70	\$3.20	\$3.05	\$3.05	2MW	\$2 Million
3/15/06	12/20/07	Res	\$3.50					None	\$38,000
3/15/06	12/20/07	Non-Res	\$3.50	\$2.50	\$2.25	\$2.00	\$1.75	2MW	\$2 Million
2/3/09	12/31/09	Res	\$1.55					None	\$17,500
2/3/09	12/31/09	Non-Res	\$1.00	\$1.00				<50 kW	\$50,000
1/1/10	4/30/10	Res	\$1.55					None	\$17,500
1/1/10	4/30/10	Non-Res	\$0.90	\$0.90				<50 kW	\$45,000
5/1/10	8/31/10	Res	\$1.35					None	\$15,500
5/1/10	8/31/10	Non-Res	\$0.80	\$0.80				<50 kW	\$40,000
9/1/10	12/31/10	Res	\$0.75					<10kW	\$7,500
9/1/10	12/31/10	Non-Res	\$0.75	\$0.75				<30 kW	\$22,500

Source: New Jersey’s Clean Energy Program website (www.njcleanenergy.com)

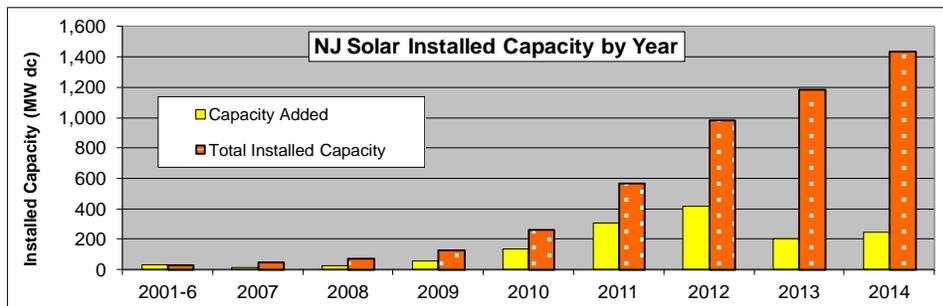
The New Jersey solar incentive programs are statewide and cover the geographic territories of all the investor owned gas and electric utilities in the state.

²⁹ SEIA, 2013state rankings

³⁰ Paraphrased from <http://www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/program-and-market-updates>

Figure 2 demonstrates the total solar installed capacity in New Jersey. As of December 31, 2014, more than 32,000 New Jersey homes and businesses have installed solar PV systems totaling approximately 1.4 GW of solar capacity.

Figure 2: Solar Capacity Installed 2001-2014



Source: NJ solar installation report 12/31/14³¹

Grant Incentive Approval Process

Delaware

Delaware has a **two-step application process for both residential and non-residential projects**. Prior to submitting the first step in the process, applicants are required to perform an **energy audit** (residential or commercial) or Energy Star Home certification. The first step is the grant reservation request. Key documents in this package include proof of an energy audit, contract documentation that the customer has committed to purchasing the system, electric bill from DPL, plot diagram, and details about the system to be installed including size, location, orientation, tilt, and shading. If the application package is complete, the Department will process the grant reservation and issue a Confirmation and Claim Form to the applicant with a pre-determined approval period which is six months for residential customers and 12 months for non-residential customers.

Once the installation is complete, the final GEF application is submitted to DNREC before the end of the approval period. This final package includes the Confirmation and Claim form signed by the customer and contractor. The package also includes copies of:

- electrical, plumbing or building inspection
- completed and approved DPL Interconnection Agreement
- product specification sheets

31

http://www.njcleanenergy.com/files/file/Renewable_Programs/CG%20Updates%20/NJ_Solar_Installations_as_of_123114.xlsx

- final sales invoice (invoice must include actual price paid, itemized list of components, labor, permit fees, method of payment)
- warranty agreement
- verification of completion of installation form signed by customer and contractor
- photos of the final system installed

Complete applications are queued for payment after final grant completion documentation is submitted and accepted by the Green Energy Program Team.³² The grant payment is made as soon as funds are available.³³ Recently added to the process is a letter to the grant payment recipient explaining the existing delayed-payment queue. The letter is mailed once the final grant package is accepted by the Green Energy Program Team. As of August 1, 2014, grant reservation requests must be done electronically as a paper option is no longer offered. The DNREC program staff plans to conduct on-site quality assurance inspections for approximately 10% of systems installed. However, this goal often has not yet been achieved due to the application volumes and program staff time constraints.

Solar Leases and Power Purchase Agreements (PPA) have been allowed to participate in the Green Energy Fund since December 10, 2010.

Maryland

Maryland has a **one-step application process for the residential program** that does not require pre-approval. The application takes place once the system has been installed. The customer must provide proof that the project: was paid in full; had the required permits; and had been inspected by the local authorities. In addition, a photo of the system must be included. The property must be a primary residence and not be held in trust. Applications must be submitted within 12 months of installation. Installation companies are required to have at least one staff person that is certified under the North American Board of Certified Energy Practitioners (NABCEP).

The steps for an application under the **commercial grant program** are similar to the residential process but involve **two steps**:³⁴

1. The submission of an application from that will result in a Grant Commitment letter from MEA if the application is accepted.
2. The submission of a Completion Package.

³² GEF Grant Confirmation and Claim Form

³³

<http://www.dnrec.delaware.gov/energy/services/Documents/December%2010%20Updates/PDF/New%20Green%20Energy%20Program%20Rules%20and%20Regulations.pdf>

³⁴ <http://energy.maryland.gov/Business/cleanenergygrants/index.html#requirements>

The application forms are electronic pdf forms for both the residential and commercial programs. Currently, program staff does not perform program inspections and relies extensively on the accuracy and detailed documentation of the paperwork received to approve projects for payment.

Effective November 14, 2013, MEA discontinued the Clean Energy Grants for leased and PPA solar PV systems in the residential market due to the overwhelming success of solar PV leasing and the strong SREC market. This discontinuation allowed MEA to shift available grant funding to other target markets and technologies. In the commercial market, leasing companies may apply for Clean Energy Grants, but solar leasing companies are required to contact the CEGP directly for an application.

New Jersey

The NJCEP no longer has a solar rebate program but projects still register with the SREC Registration Program (SRP). However, during the seven years that the Office of Clean Energy managed the renewable incentive programs, the rebate process remained relatively the same. As the delayed-payment queue started to grow, the application process became more refined, requiring the application packages to be mailed to the office instead of accepting e-mails. Also, the packages had to include all required documents or they would be returned for resubmittal.

There were **two steps** to the process and those same two steps continue today for the SRP. The first step focused on allocating the rebate when rebates were available; now, this first step registers projects in the SRP. The second step happens once the installation is complete and is used to document what was installed and the utility's approval of the interconnection agreement. Program administration staff performed on-site inspections for 100% of the projects in the early years of the program, reducing that number to just 10% on-site inspections being performed today. Because of the limited program inspections, the final paperwork packet, until January 2015, included documentation about the system that would have normally been gathered during an inspection process. This provided program staff the assurance that the project was built to the paperwork submitted.

Solar leases and PPA agreements participate extensively in the SRP and were also eligible to participate in the rebate programs until May 1, 2010, a few months before the rebate program ended on December 31, 2010.

SREC Market

Delaware

The Renewable Portfolio Standard (RPS) in Delaware allows large industrial users to opt out of meeting the standard, and enables DPL to receive credit for the use of Bloom Energy natural gas fuel cells toward the solar carve-out portion of their RPS requirements. In 2011, the Delaware State Legislature amended the solar portion of the RPS to switch the burden of acquiring SRECs from power providers to the electric distribution companies. This amendment drastically reduced the number of buyers, effectively making DPL the long-term buyer for the majority of the SREC requirement. Therefore, the estimates for procurement are based on DPL's projected need for

SRECs in each compliance year. DPL’s obligation for compliance in 2013 was 39,627 SRECs, accounting for approximately 30 MW of capacity. Currently according to the SEIA website Delaware had 61 MW of installed capacity as of 12/31/14³⁵.

Additionally, DPL procures SRECs through SREC Delaware, a procurement program which provides 20-year contracts to SREC sellers on a competitive basis. The annual auction takes place in April. The price of SRECs is market bid for the first seven years, and fixed at \$35 for the next 13 years. For the 2015 auction, the price of SRECs is market bid for the first 10 years and fixed at \$35 for the next 10 years. Eligible system size is up to 2 MW.³⁶ Facilities that qualify as being built with either Delaware labor or Delaware manufactured parts may be granted an SREC bonus of 10% for each qualification.³⁷

For the auction, the SREC prices are determined separately by tier for new and existing projects (defined as built before April 12, 2013, for the 2014 solicitation), see **Table 6**. Each program tier had its own pricing, bid rules, and terms and conditions.³⁸ **Table 7** highlights the winning bids for 2014.³⁹

Table 6: SREC Tiers in Delaware

	Tier	Size (kW)	Number of SRECs per year	Estimated Contract award scenarios
New	N-1	<30	3,800	~(630) @ 5kW
	N-2	31-200	1,400	~(23) @ 50kW
	N-3	201-2,000	1,400	~(2) @ 500kW
Existing	E-1	<30	3,800	~(630) @ 5kW
	E-2	30-2,000	3,800	~(323) @ 100kW

Table 7: 2014 SREC Prices by Tier in Delaware

	Low	High	Weighted Average
N1,E1,E2	\$0.00	\$300.00	\$53.44
N2	\$34.46	\$141.23	\$88.84
N3	\$98.73	\$98.73	\$98.73

Recently, the Delaware Sustainable Energy Utility (DESEU) began to offer an alternative to the annual auction or spot market for selling SRECs. The SREC Purchase Program is an upfront

³⁵ <http://www.seia.org/state-solar-policy/delaware>

³⁶ DSIRE, accessed 12/31/2014

³⁷ http://www.sretrade.com/srec_markets/delaware

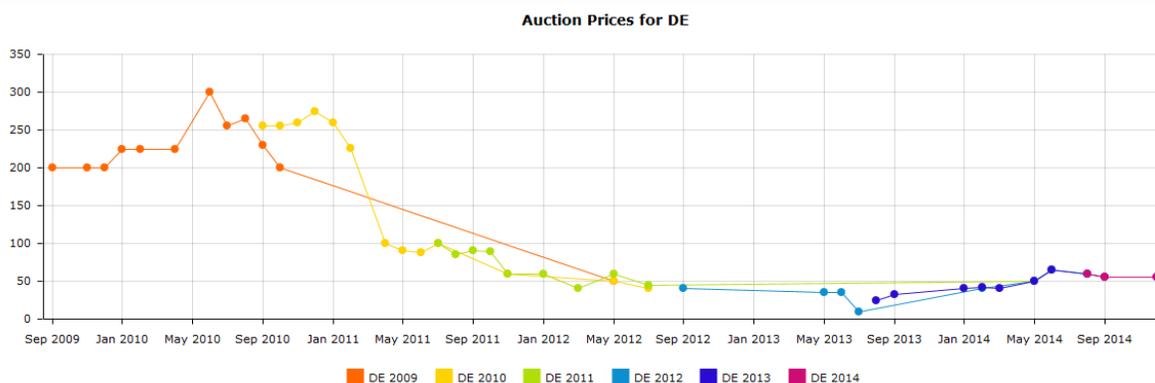
³⁸ DSIRE, accessed 12/31/2014

³⁹ DSIRE, accessed 12/31/2014

payment of \$450/kW in exchange for the first 20 years of SRECs created by a solar system. This program is open to all Delaware residents who install Delaware-sited systems less than or equal to 50kw in size. In order to be eligible for the program, systems must have a final interconnection date after August 4th, 2014. When the rebate amounts were changed effective August 1, 2014, this program provided another upfront incentive to help Delaware residents with the upfront costs of solar PV.

SREC prices in Delaware were around \$200-300 in 2009 and have declined to about \$50 per SREC by 2012. They have been relatively stable since (Figure 3).⁴⁰

Figure 3: Historical SREC Prices in Delaware



Maryland

Under Maryland law, all net-metered customers and renewable on-site generators in Maryland own all RECs or SRECs produced by their systems unless or until a customer or generator chooses to sell or otherwise transfer the RECs or SRECs to another party. In order to begin producing SRECs for the Maryland RPS, a solar generator must apply for certification as a qualifying generator from the Maryland Public Service Commission (PSC). Out of state resources have been ineligible since 2011. Owners of PV systems of **10 kilowatts (kW) or smaller** (referred to as Level 1 solar facilities) that are used for on-site generation **may use an engineering estimate** based on an energy production schedule established by the PSC in lieu of providing actual generation data. Owners of systems that are not certified as Level 1 solar facilities are also required to submit an on-site generation form to the PSC within one week of entering their generation data into the PJM-GATS system. In a characteristic unique to Maryland, solar generators in Maryland are required to offer SRECs for sale to Maryland electricity suppliers prior to offering them for sale to any other buyer. In order to help generators comply with this requirement, the PSC operates a web site where generators can post SREC offers.

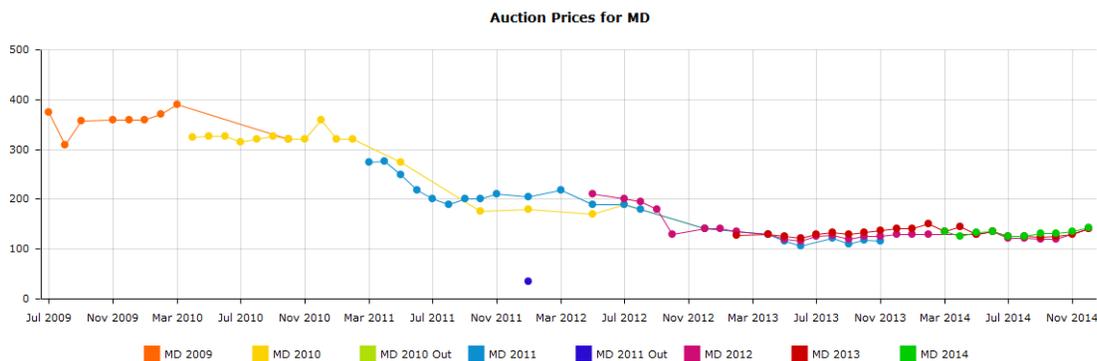
⁴⁰ http://www.sretrade.com/srec_markets/delaware

The price varies based on market conditions; as of September 2014, Maryland-sourced SRECs traded at an average of \$141.30/MWh (\$0.14/kWh) during 2014 based on data reported by PJM-GATS. The theoretical maximum is \$400/MWh (the 2012 Solar Alternative Compliance Payment, or SACP) for SRECs used for compliance under the MD RPS. The SACP will decline to \$50/ MWh by 2023. There are no specific size limits but systems generally must be connected to the distribution system serving the state in order to qualify; residential solar water heating systems are limited to producing five SRECs annually.⁴¹

A proactive state legislature and aggressive SREC requirements have kept this market relatively stable since its inception in 2008. Only Maryland-sited facilities may register for the Maryland SREC program. Certain Maryland-sited solar water heating systems are also eligible to produce SRECs.⁴²

Figure 4 demonstrates that the auction prices for SREC for Maryland were around \$350 in 2009 and have steadily declined to about \$120 in 2012 and have been relatively stable since.⁴³

Figure 4: Historical SREC Prices in Maryland



New Jersey

Solar projects installed in New Jersey that participated in previous incentive programs or are registered with the SREC Registration Program (SRP) are qualified to generate Solar Renewable Energy Certificates (SRECs). All electric suppliers supporting the New Jersey electricity market must use the SREC program to demonstrate compliance with the RPS. The price of SRECs is determined primarily by their market availability and the price of the Solar Alternative Compliance Payment (SACP) for the state RPS.

Prior to 2008, the SACP was set at \$300 per MWh. This was amended, and an eight-year schedule was established by the BPU for Energy Year (EY) 2009 - 2016. In 2012, S.B. 1925

⁴¹ DSIRE, accessed 12/31/2014

⁴² http://www.srectrade.com/srec_markets/maryland accessed 12/31/2014

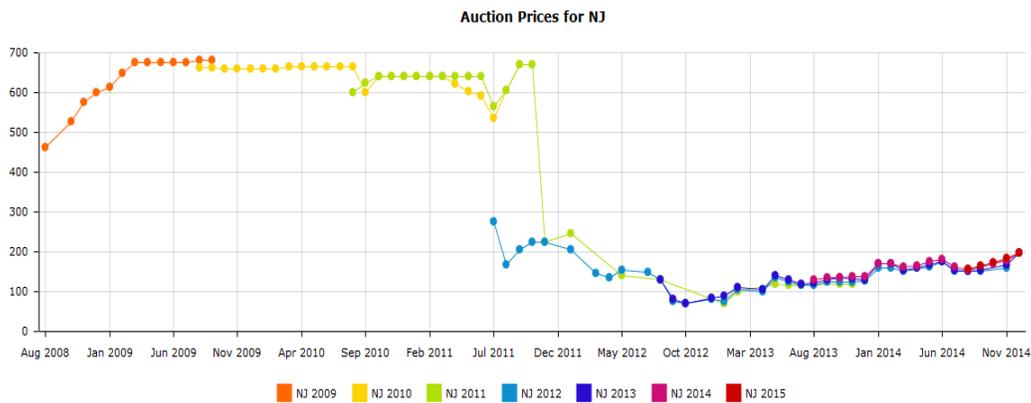
⁴³ http://www.srectrade.com/srec_markets/maryland

established a new 15-year schedule for EY 2014 - 2028. The new schedule sets the ceiling price in the mid-\$200 range for each energy year.⁴⁴

Solar facilities have a 15-year "qualification life", meaning that they are eligible to generate SRECs for 15 years after they are connected to the grid. As of November 30, 2012 all systems were required to install a revenue grade meter to track production. Following that date, SRECs are issued to systems based only upon readings obtained from a revenue-grade meter measuring the system output.⁴⁵

SREC prices vary according to supply and demand in the market. Starting in EY2012 (July 2011 – June 2012) there was an oversupply of SRECs which made the prices drop significantly. The wide fluctuations in SREC prices in the New Jersey market have been a significant concern to the regulators and the solar industry. However, more recently the SREC price seems to have stabilized around \$150-\$180. **Figure 5** shows the historical SREC prices in New Jersey.⁴⁶

Figure 5: Historical SREC Prices in New Jersey



⁴⁴ DSIRE assessed on 12/31/14

⁴⁵<http://www.njcleanenergy.com/renewable-energy/programs/metering-requirements/production-meter-requirements-solar-projects-sreCs>

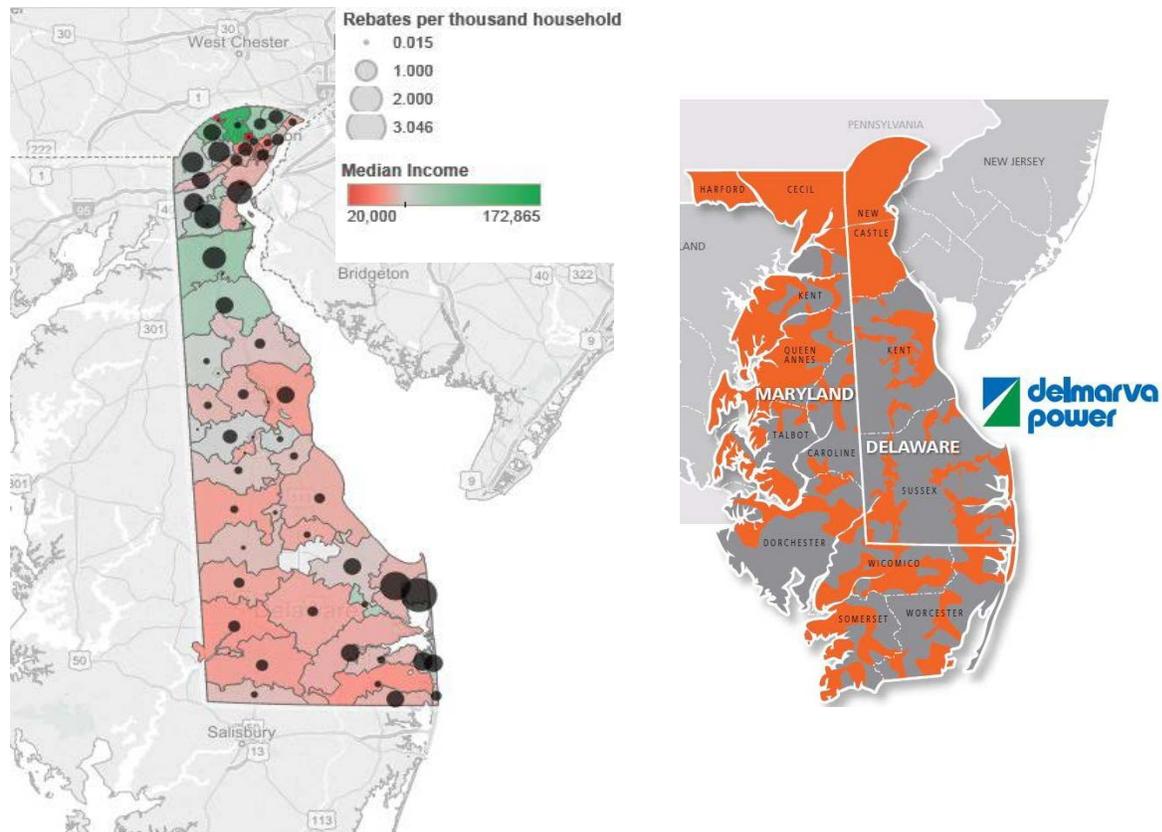
⁴⁶ http://www.srectrade.com/srec_markets/new_jersey

Program Results for the Green Energy Fund

Geographic Distribution for Participation

A map of the distribution of incentives by zip codes reveals that the program has good success reaching customers in all areas of the Delmarva territory (**Figure 6**),⁴⁷ with a greater than average uptake of rebates in the beach areas of Sussex County. When considering median income in each zip code, areas with lower median income have seen lower participation. However, these areas are also not served as much by Delmarva power (especially Kent County). Overall, the greatest participation has been in eastern Sussex County, followed by northern New Castle County.

Figure 6: Number of Solar Rebates Awarded, by Zip Code, and Delmarva Service Territory where the GEF Incentive is offered.

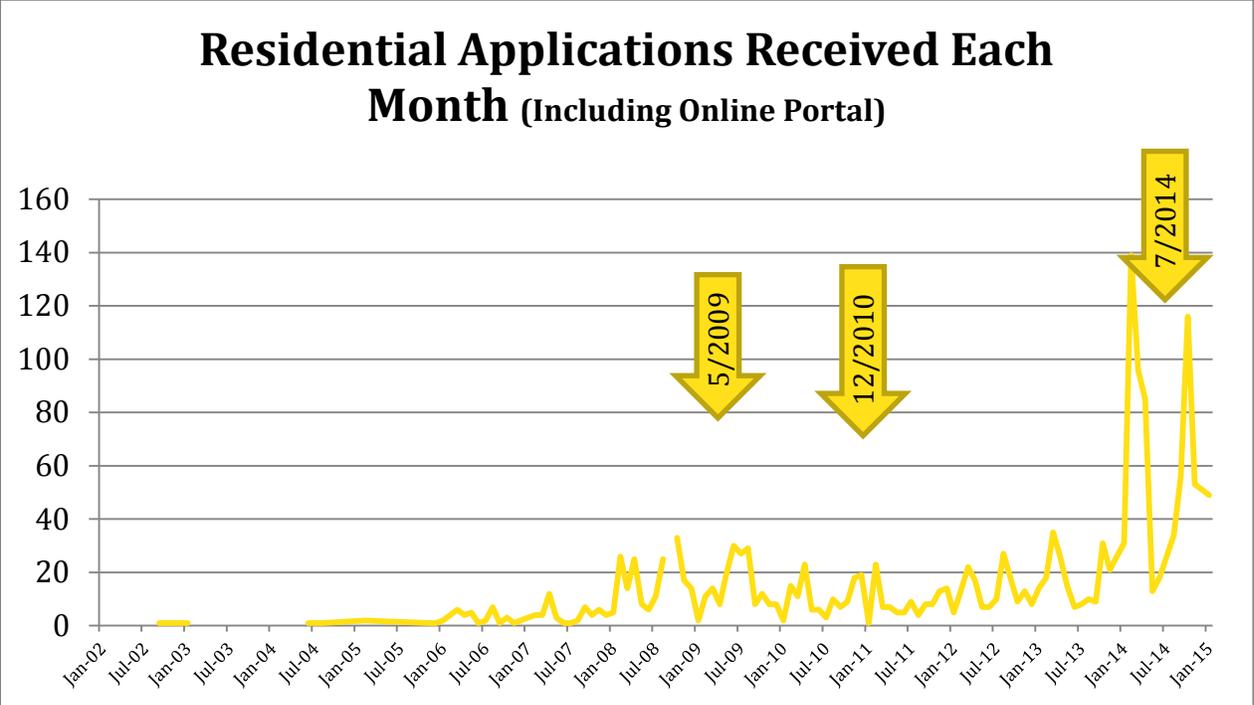


⁴⁷ rebate per thousand household, 2002-2014 including 2014 online portal data

Program Metrics

Residential applications received each month have been increasing in number since 2002 (Figure 7). The trend was especially pronounced in 2014 when 571 applications were received in the program compared to 284 applications in 2013. Yellow arrows indicate when the rebate level was changed. The change in rebate level did not affect the monthly residential application volumes, as projects had been applying for incentives at a steady pace since mid-2007. The only exception has been the more recent significant increase in the number of residential applications received per month since early 2014, with the trend continuing into 2015.⁴⁸

Figure 7: Residential Applications Received by Month



The installed cost of PV systems has declined rapidly. Simultaneously, the average system size of residential installations has grown. (Figures 8 and 9) Additionally, the analysis of existing application data highlights possible inflated average cost per watt because in some cases PPA and solar lease system costs are reported to the program based upon the sum of the homeowner’s PPA or lease payments. This would not be considered a realistic system cost since PPAs and lease companies have significant purchasing power. On the non-residential side, there was a backlog in applications which prompted a program change in 2010 when the 50kW system size

⁴⁸ From project tracking spreadsheets from GEF staff in January 2015

limit was implemented. This change helped eliminate the backlog and resulted in lower average system size incented by the GEF program.

Figure 8: Average Capacity and Cost for Residential Rebates (GEF)

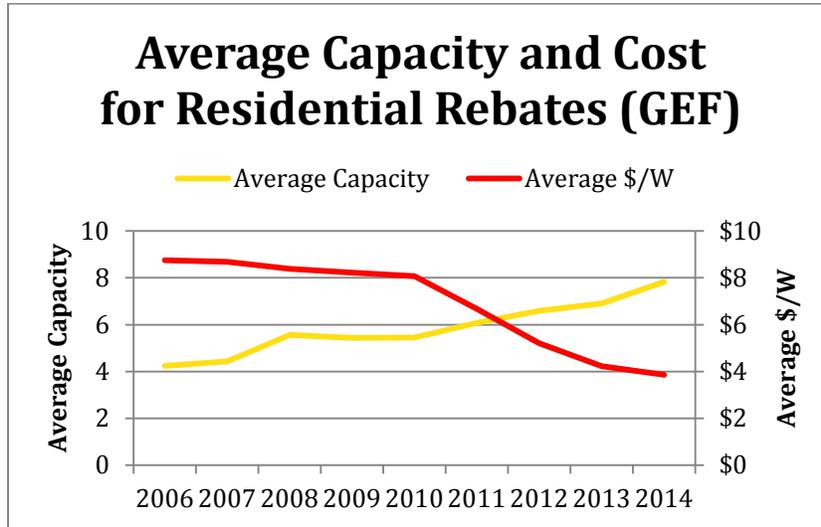
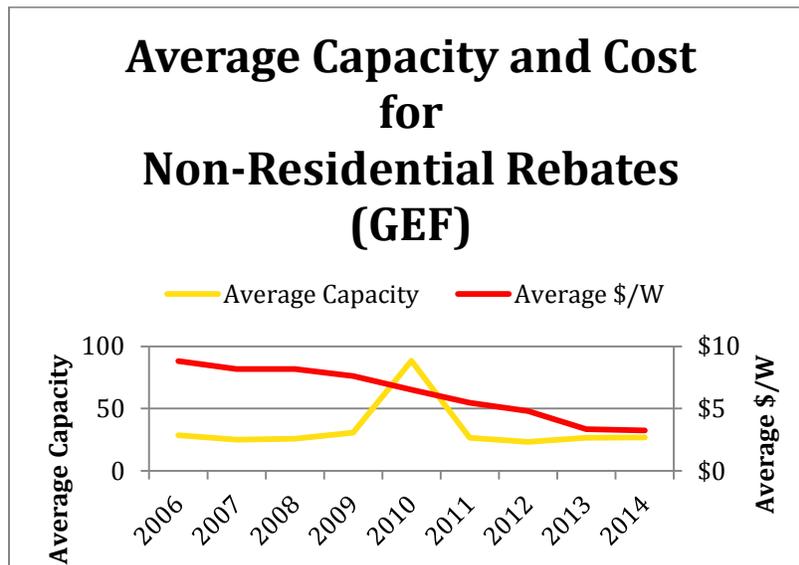


Figure 9: Average Capacity and Cost for Non-Residential Rebates (GEF)



Source: From project tracking spreadsheets from GEF staff in January 2015

size for receiving The number of grants awarded by the program since 2006 has been growing rapidly, as have the number of projects requesting grants. (Figure 10) The grant amount paid was greater for applications submitted in 2008 and 2009 than in recent years, but that was due to the availability of ARRA funds. A non-residential backlog was present in 2010 until application rules were changed to reduce the maximum system a rebate to 50kW or smaller. The number of

projects pending completion has also grown significantly for the residential sector, as indicated by the grant amount pending in years 2013 and 2014.⁴⁹ (Figure 11)

Figure 10: Number of Grants Awarded, by application year, 2002-2014

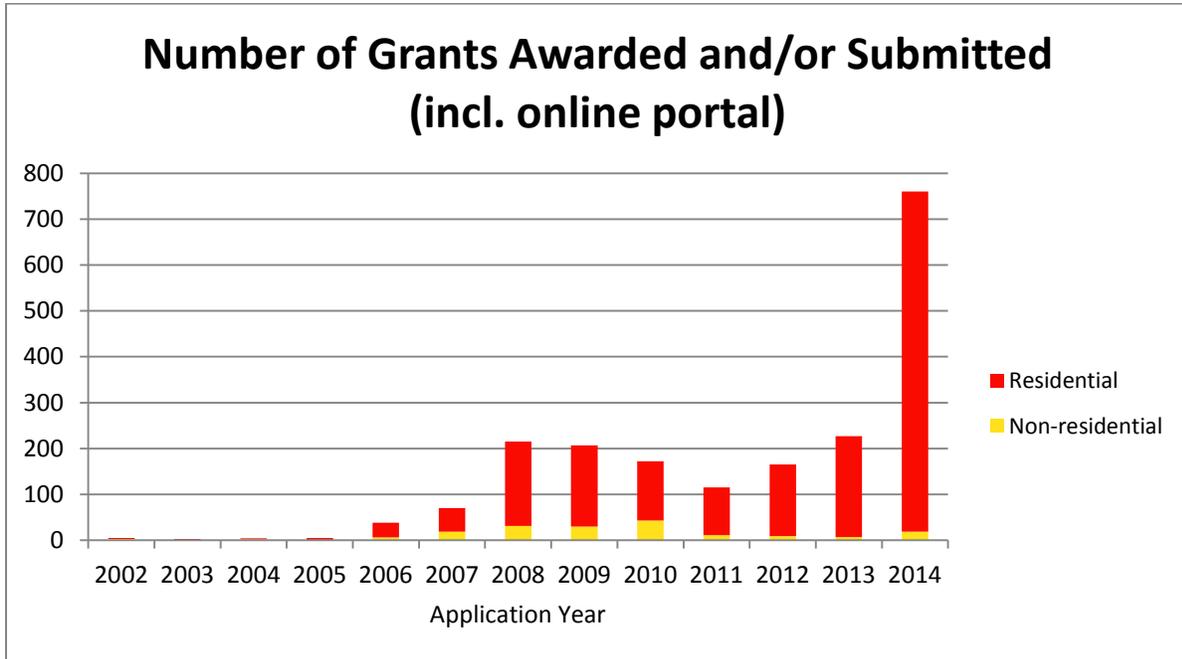
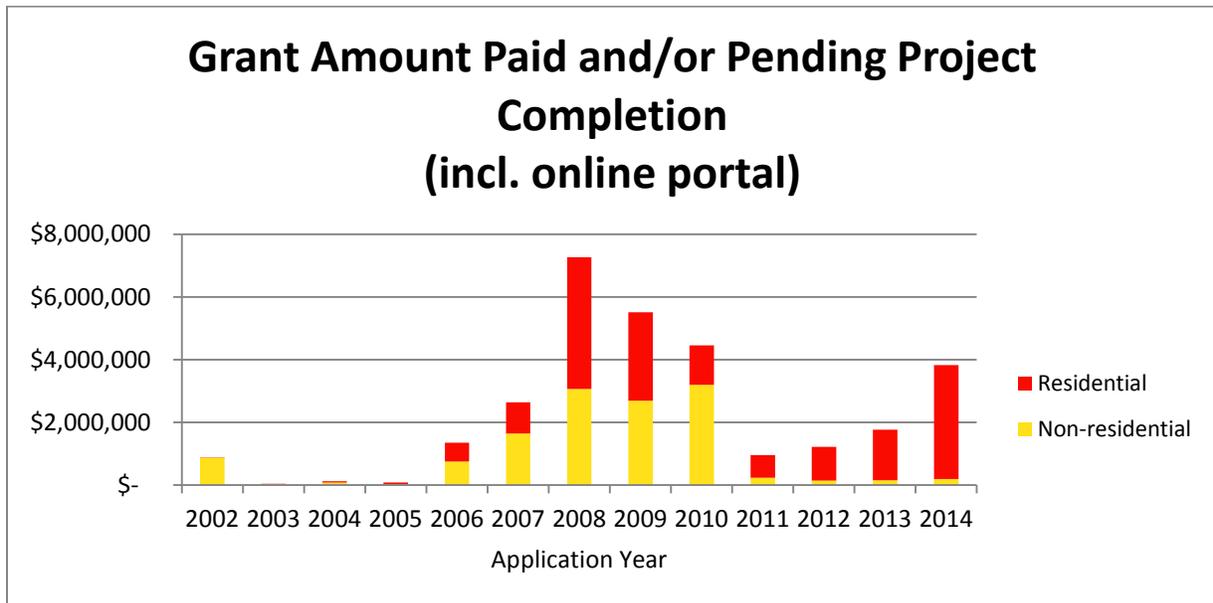


Figure 11: Grant Amount Awarded, by application year, 2002-2014



⁴⁹ From project spreadsheets provided by GEF staff in early 2015

Under the new online portal (started August 4, 2014), more details are captured regarding system ownership and system characteristics. From August 4, 2014 to December 31, 2014, PPA / leased systems accounted for 75% of the residential projects received in the program. The table below applies only to rooftop systems. Although other systems (i.e., ground and tracking systems) are occasionally installed, rooftops dominate the market. Therefore, ground and tracking systems were removed from this analysis. The characteristics from the results of this analysis were used in the financial analysis.

Table 8: Resident-owned versus PPA / leased Systems, plus Characteristics Used in Financial Analysis, Online Portal, and (August – December 2014)

	Ownership Type	Number of Grant Applications	Average Output (kW)	Average Tilt	Average Azimuth
Non-residential	Owned	4	20.0	30	188
Residential	PPA / lease	210	7.8	28.8	190
	Owned	50	7.7	28.6	194
Residential Average		260	7.8	28.7	191

Analysis of Customer Financial Economics

Methods

The goal of the financial analysis performed by VEIC was to depict the current financial picture experienced by solar PV owners and residential hosts of PPA / leases.

We chose the net-present value of the solar PV system as the criteria of comparison among scenarios, because it reflects the multi-year value of the system to the customer or PPA / lease companies. The goal of an incentive program should be to keep the NPV of the system above zero so that customers see a positive return on their investment.

We considered four ownership and financing scenarios: 1.) residential ownership, 2.) commercial ownership, 3.) residential PPA / lease (homeowner perspective), and 4.) residential PPA / lease (PPA / lease company perspective).

For these four scenarios, we looked at two ITC levels (30%, and reduced ITC: 0% for residential and 10% for commercial / PPA ownership). Both the commercial and residential ITC are credits equal to 30% of the basis that is invested in eligible property that is placed in service before December 31, 2016. After this date, the commercial credit (under Section 48) is speculated to drop to 10 percent and the residential credit (under Section 25D) will drop to zero—unless Congress extends this deadline or changes the “placed in service” component of the law to a “commence construction” provision.⁵⁰

There are widely accepted tools that take these factors into account to calculate returns on investments. NREL’s System Advisor Model (SAM) is one of those models and it was used to model prototypical installations under different ownership and incentive scenarios. The resulting payback periods and cash flows were compared. The version of SAM used was Version 2015.1.30, 64 bit. Outputs from the tool are from a system owner’s point of view (property owner or PPA / lease company, depending on the financing model). In addition to the incentive level, a number of other factors impact a customer’s financial return on an investment in distributed PV. These include: the available solar resource at a site, the total installed costs for a system (which is influenced by the site-specific conditions, local market infrastructure, and global/regional competitive pricing trends), and the availability of financing (either directly or through solar companies). A list of the inputs used in the model can be found in Appendix C.

Inputs included increased property tax value because reports have found that the value of the home increases with the installation of the solar PV system.⁵¹ That increase in property tax is very minor and does not significantly affect the economics of the system over 20 years.

⁵⁰ SEIA website

⁵¹ Selling into the Sun, LBNL

For the residential PPA / lease homeowner perspective, a custom Excel spreadsheet was created to calculate net present value of savings over the timeframe of the analysis. The input for the spreadsheet mirrored those of the SAM tool, and the PPA / lease cost/kWh of \$0.13 was used. Delaware stakeholders have shared that the monthly lease amount is very similar to the monthly PPA amount, so these two types of contracts are treated the same in our analysis.

A similar analysis was done for residential ownership for Maryland and New Jersey, with and without ITC but without varying the incentive level. Most inputs for the Maryland and New Jersey analysis remained the same as for the Delaware analysis, except for incentives: \$1,000 for MD, and \$0 for NJ; and SREC: \$120 for MD, and \$150 for NJ (MD assumes a 0% increase in property tax).

Results and Discussion

The net present value of the solar PV system is presented below (**Tables 9 & 10, Figure 12**) for the four ownership and financing scenarios: 1.) residential ownership, 2.) commercial ownership, 3.) residential PPA / lease (homeowner perspective), and 4.) residential PPA / lease (PPA / lease company perspective), and the two ITC levels.

With changes in incentive levels or changes to the ITC, residential PPA / lease companies are likely to adjust the terms of their product. As we cannot accurately predict what this adjustment will look like, we present information on what the current situation looks like (\$0.63/W incentive = \$4,950 for an average system size; ITC at 30%).

Key assumptions for the analysis focusing on the residential system were:

- 7.8 kW system at \$3.90 per Watt for resident-owned projects, and \$3.20 per Watt for PPA / lease company owned projects.
- For the resident-owned scenario, 70% of system cost is financed for 15 years at 4% interest (home equity loan).
- Solar array produces 10,643 kWh in Year 1, with production declining slightly each subsequent year due to system degradation.
- Residence consumes 13,000 kWh per year.
- Residential rebate is \$4,950; SREC grant is \$3,510; investment tax credit is \$6,600.
- PPA / lease agreement is fixed at \$0.13 per kWh for 20 years.
- The analysis looks at a scope of 20 years, since that is the regular contract term for PPA / leases.
- DPL electricity rates are just under \$0.12 per kWh.
- Electric rate increase is anticipated to be comparable to past history: approximately 2.5% per year.

Key assumptions for the analysis focusing on the non-residential system were:

- 26.9 kW system at \$3.20 per Watt for commercial ownership projects

- Solar array produces 36,704 kWh in Year 1, with production declining slightly each subsequent year due to system degradation.
- 70% of system cost is financed for 15 years at 4% interest.
- Business consumes 133,045 kWh per year.
- Rebate is \$9,725; SREC grant is \$12,105; investment tax credit is \$25,824.
- The analysis looks at a scope of 20 years
- DPL electricity rates are just under \$0.11 per kWh.
- Electric rate increase is anticipated to be comparable to the past: about 2.5% per year.

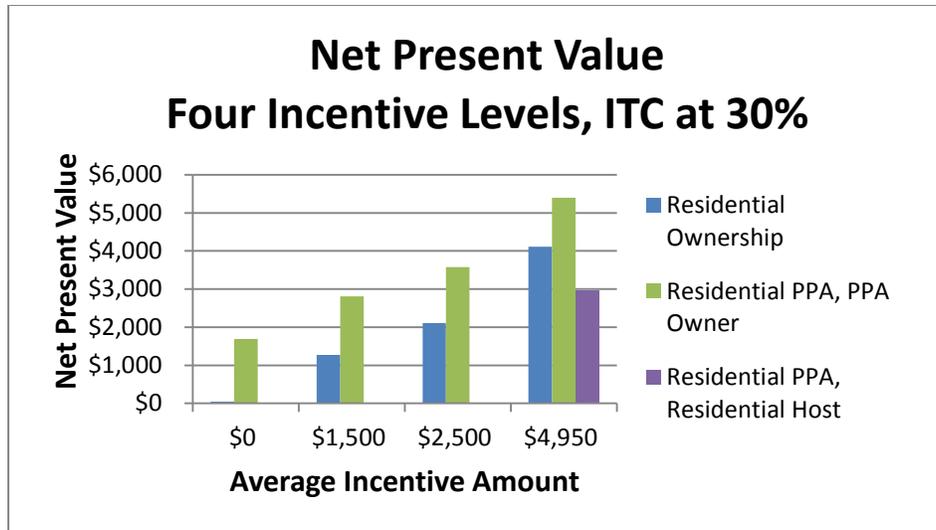
As **Table 9** and **Figure 12** show, the NPV analysis indicates positive returns from much lower rebates, especially with the commercial and PPA / lease company ownership.

Table 9: Customer economic analysis, in terms of NPV, with the prevailing investment tax credit in effect until December 31, 2016

		System Owner Perspective			Residential Host Perspective*
		Residential Ownership	Commercial Ownership	PPA / Lease Company Ownership	PPA / Lease Company Ownership
Incentive		NPV after tax			NPV after tax
ITC at 30%	\$0	\$42	\$699	\$1,692	<i>Depends on resulting adjustments to PPA rates and monthly lease fees, if necessary</i>
	\$1,500	\$1,269	\$3,945	\$2,811	
	\$2,500	\$2,108	\$6,165	\$3,576	
	\$4,950/\$9,725	\$4,110	\$11,461	\$5,401	

*Stakeholders indicated that monthly lease payments / PPA payments are very similar; they are treated as one and the same in this analysis.

Figure 12: NPV for solar PV using four different incentive levels



The NPV analysis was also calculated with the reduced federal Investment Tax Credit that has been proposed for systems installed after December 31, 2016. This change will not only affect the Delaware solar market, but the general U.S. solar market. **Table 10** shows the effects of this anticipated change. These numbers do not reflect the effects of other factors that are currently unpredictable, but which could also change the economics.

Table 10. Customer economic analysis – NPV with the proposed ITC (2017 and beyond)

		System Owner Perspective			Residential Host Perspective*
		Residential Ownership	Commercial Ownership	PPA / Lease Company Ownership	PPA / Lease Company Ownership
Incentive		NPV after tax			NPV after tax
Reduced ITC (0% residential, 10% commercial and PPA)	\$0	(\$8,602)	(\$2,833)	(\$2,358)	<i>Depends on resulting adjustments to PPA rates and monthly lease fees, if necessary</i>
	\$1,500	(\$7,375)	(\$587)	(\$1,240)	
	\$2,500	(\$6,536)	(\$366)	(\$474)	
	\$4,950/\$9,725	(\$4,534)	(\$71)	\$1,351	

*Stakeholders indicated that monthly lease payments / PPA payments are very similar; they are treated as one and the same in this analysis.

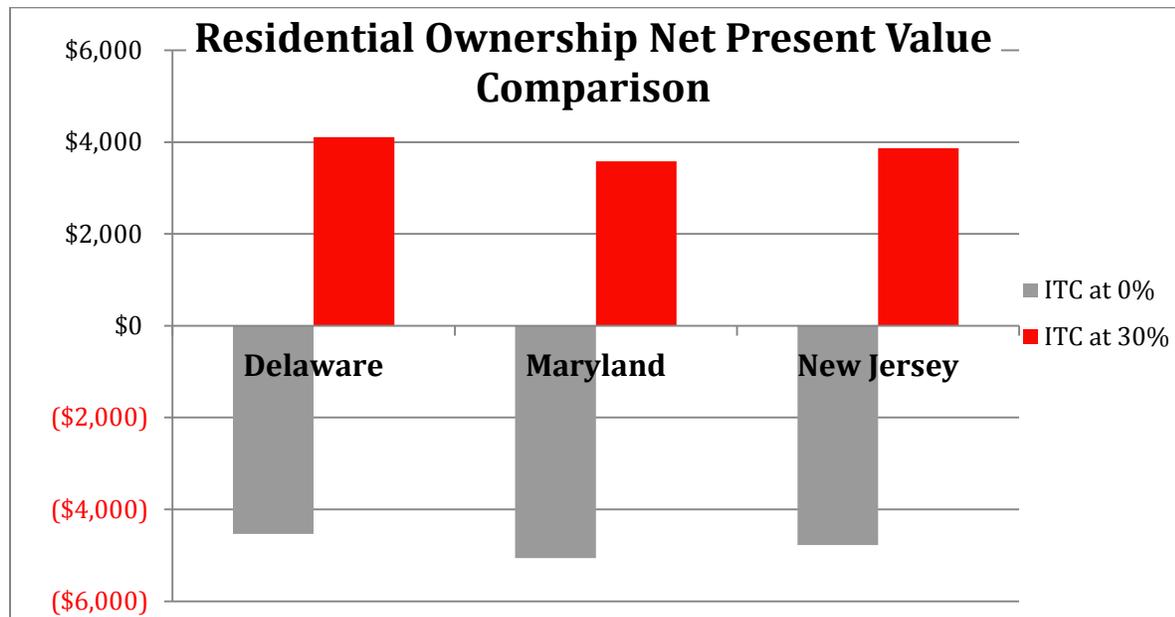
Table 11 and Figure 13 compares the NPV for Delaware with Maryland and New Jersey residential systems using the same inputs for Maryland and New Jersey except for incentives: \$1,000 for MD, and \$0 for NJ; and SREC: \$120 for MD, and \$150 for NJ. (MD assumes 0% increase in property tax) While almost all installed systems in New Jersey and approximately

75% of those installed in Maryland are PPA / leases, comparing PPAs in these states was not possible, as we did not know what lease or PPA terms were typical in those states. Comparing ownership costs provides a point of reference and indicates that in Maryland and New Jersey, with minimal or no state incentive, systems see a positive net present value similar to Delaware, thanks to higher SREC values in those states. Detailed inputs can be found in Appendix D.

Table 11: NPV Comparison DE, MD, and NJ for Residential Systems

	Delaware	Maryland	New Jersey
	current grant incentive level	current \$1,000 grant incentive	no grant incentive
Federal ITC percentage (% of installed cost)			
ITC at 30%	\$4,110	\$3,581	\$3,866
ITC at 0%	(\$4,534)	(\$5,063)	(\$4,778)

Figure 13: NPV Comparison DE, MD and NJ for Residential Systems



The annual and cumulative cash flow analyses, shown in **Figures 14 and 15**, using the stated assumptions, also show that over the 20-year term the resident-owned systems will provide a positive cumulative cash flow of \$8,900, with most of the savings accumulating after the system is paid off in years 16 – 20. The resident-owned system would also see additional positive returns after Year 20 for the rest of the life to the PV system.

The annual and cumulative cash flow analyses, under the same assumptions, show that over the 20-year term, the PPA / lease system will provide a positive cumulative cash flow of \$4,700,

with savings starting once the electric rates are more than the fixed PPA rate of \$0.13 per kWh. This calculation does not include any fees associated with purchasing the system at the end of the PPA / lease.

The detailed cash flow analysis can be found in Appendix E.

Figure 14: Annual cash flow

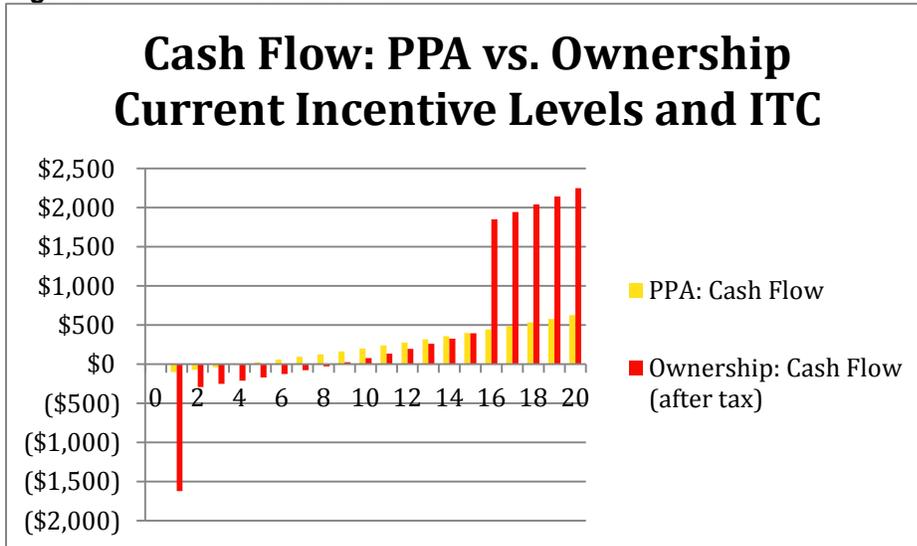
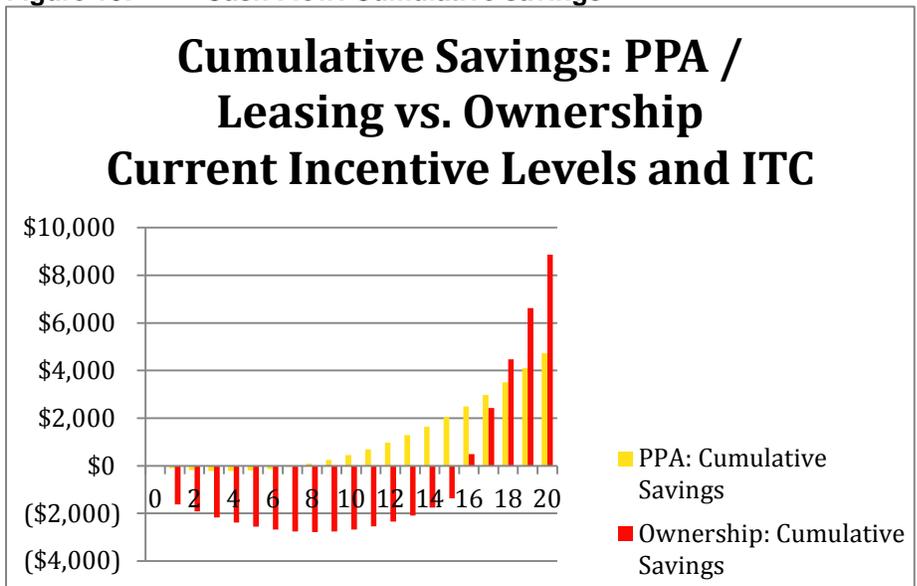
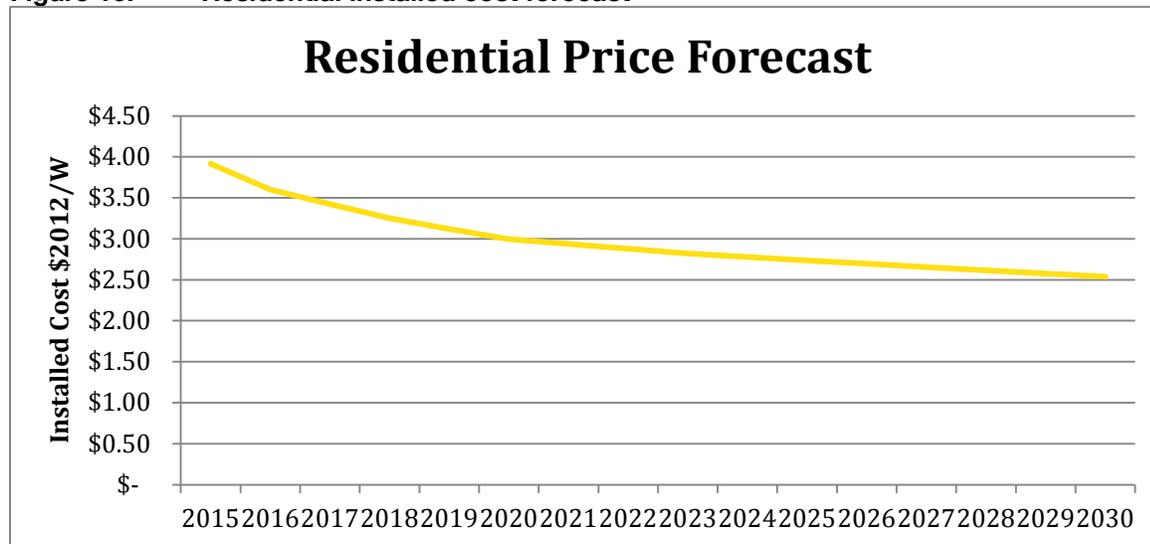


Figure 15: Cash Flow: Cumulative savings



The price of solar PV has been declining. Published estimates of the cost trends for solar PV **Figure 16**⁵² indicate that the price of solar PV is likely to continue declining initially, but then is expected to stabilize.

Figure 16: Residential installed cost forecast



Installed prices continued declining in 2013, falling year-over-year by \$0.70/W, or 12-15% depending on the system size range. Data for the first six months of 2014 indicate that installed prices continued to fall, with the median installed price of systems in a number of the larger state markets declining by an additional \$0.20/W to \$0.50/W (5-12%) depending on system size, relative to the price of systems installed throughout 2013.⁵³

⁵² Energy Efficiency and Renewable Energy Potential Study of New York State – April 2014, Volume 3, Figure 24, Upstate and Long Island Forecast, <http://www.nyseda.ny.gov/Cleantech-and-Innovation/EA-Reports-and-Studies/EERE-Potential-Studies>

⁵³ 2014 LBNL Tracking the Sun VII Report

Findings and Recommendations

Overview of Key Findings

Solar Capacity. Delaware has made good progress in increasing its installed solar capacity compared to other states in the Mid-Atlantic and Southern New England regions. As shown in **Table 12**, Delaware is positioned just below the two market leaders (New Jersey and Massachusetts) in per-capita capacity, and well above Maryland and Pennsylvania. The majority of this capacity is located within the Delmarva Power and Light (DPL) service territory. DPL started programs years earlier and has larger budgets than the Delaware Municipal Electrical Corporation and Delaware Electric Cooperative.

Table 12. Comparison of solar industries in the Mid-Atlantic and Southern New England Regions, 2013

	Regional Market Leaders			Other States in the Region				
	NJ	MA	DE	MD	PA	DC	NY	CT
MW of solar installed per million residents in 2013	26.4	35.4	9.6	4.9	3.0	2.9	3.5	10.3
MW of solar installed per million residents cumulative through 2013	153.2	101.2	63.1	31.1	18.8	12.9	17.2	24.7

Source: Solar Energy Industries Association (SEIA)

Solar Renewable Energy Credit (SREC) Market. The Renewable Portfolio Standard (RPS) in Delaware allows large industrial users to opt out of meeting the standard, and enables DPL to receive credit for the use of Bloom Energy natural gas fuel cells toward the solar carve-out portion of their RPS requirements. In 2011, the Delaware State Legislature amended the solar portion of the RPS to switch the burden of acquiring SRECs from power providers to the electric distribution companies. This reduced the number of buyers, effectively making DPL the long-term buyer for the majority of the SREC requirement. Estimates for procurement are based on DPL’s projected need for SRECs in each compliance year. DPL’s obligation for compliance in 2013 was 39,627 SRECs, accounting for approximately 30 MW of capacity. According to the SEIA website, Delaware had 61 MW of installed capacity as of 12/31/14. DPL met this capacity requirement through existing contracts, the annual power auction, and spot market purchases. The average price for the auction was approximately \$53 per SREC for a typical <30 kW PV system. **Table 13** shows 2014 prices in Delaware, Maryland, and New Jersey.

Table 13. SREC auction prices for the market below 30kW

	Delaware	New Jersey	Maryland
SREC average price during 2014	\$53	\$160	\$140

Source: SREC Trade's website: http://www.srectrade.com/srec_markets/introduction.

Stakeholders have shared their concerns with the low SREC prices in Delaware compared to New Jersey and Maryland and expressed this as a reason for the reliance on higher incentives in Delaware. More information from the stakeholder engagement can be found in Appendix A.

Program Funding. GEF funds become available each month allocated into residential and non-residential pools. Approximately \$2.6 million is available per year for the GEF. Sixty percent (60%) of the funds are allocated to the residential pool and forty percent (40%) to the non-residential pool. Approximately \$1.5 million is available each funding year for all residential renewable energy projects. This monthly allocation is in contrast to funds in New Jersey and Maryland, which are treated as annual budgets with one pool of funding allocated to the renewable energy programs. **Table 14** highlights available funding in past years for the GEF. The numbers for Funding Year 2015 are partial as March, April, May and June deposits have not yet been received.

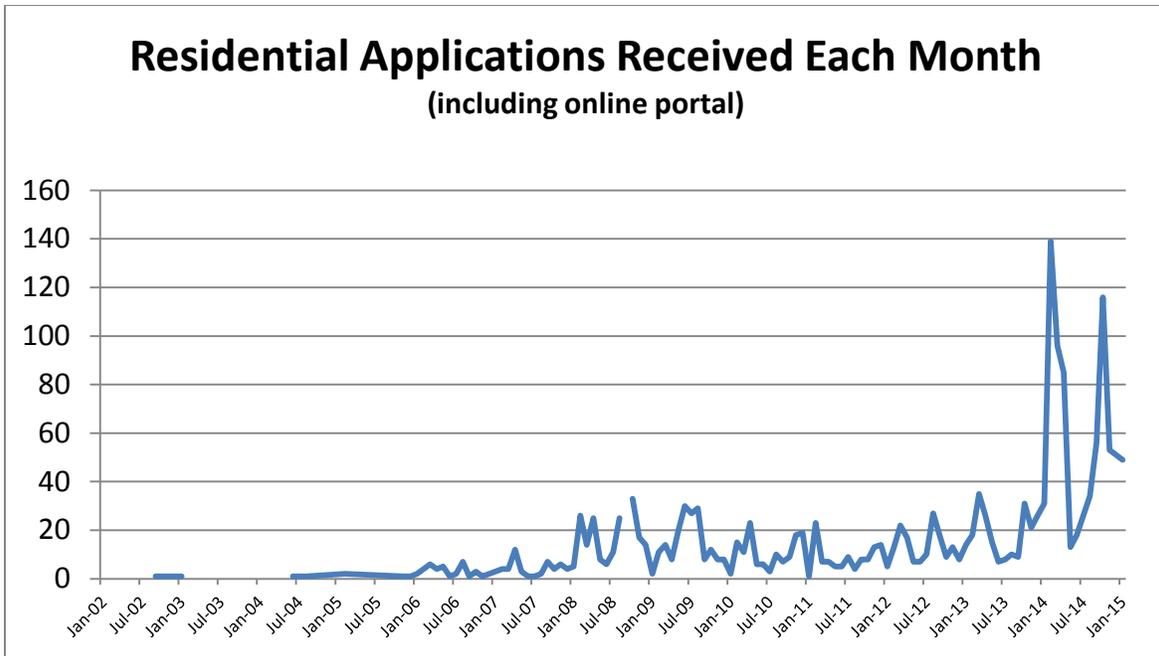
Table 14. Annual Delmarva Power and Light Deposits to the GEF

Funding Year	Residential	Non-Residential	Total
July 2012 - June 2013	\$1,572,119.05	\$1,122,110.80	\$2,694,229.85
July 2013 - June 2014	\$1,588,556.72	\$1,059,037.80	\$2,647,594.52
July 2014 - February 2015 (partial year)	\$1,173,025.82	\$782,017.20	\$1,955,043.02

Source: DPL deposit breakdown as supplied by DNREC staff

Funding Requests. Monthly reservation requests to the GEF for residential incentive grants for solar PV projects have been increasing. This trend was especially pronounced in 2014 when the GEF received 571 applications, compared to 284 applications in 2013. The majority is for residential projects with an increased number of PPA / lease projects, as shown in **Figure 17**.

Figure 17. GEF monthly trend for residential applications received



Source: DNREC provided project application spreadsheets through January 15, 2015

Eligibility for Incentives. The GEF currently provides grants both for resident-owned PV systems and for residential systems financed with a PPA / lease. In contrast, Maryland provides grants only for resident-owned PV systems and New Jersey no longer provides grants for residential solar PV systems. All three states provide SRECs.

Payment Queue. Delayed payments are a factor in strains on the GEF. The delayed-payment queue for residential projects, reported on the DNREC website, lists over \$800,063.50 for 98 residential projects in the queue. These projects are primarily for solar PV, solar hot water, wind, and geothermal installations. The DNREC GEF webpage on May 11, 2015 advised that:

“ADVISORY: Effective April 2015, there is currently a delayed payment queue of more than 30 months for the DPL Residential Rebate Program. Please be aware that this payment queue continues to grow as the Division of Energy & Climate is receiving an unprecedented number of applications for rebate incentives.”

A review of the GEF project tracking spreadsheet and the online application reports sheds light on factors contributing to the payment queue. **Table 15** provides information on the number of grant reservations requests and final completion package status for residential solar PV systems as of March 11, 2015.

Table 15: Status of projects in the GEF as of March 11, 2015

Source	Grant Reservation Request Status	Final Package Status	Number of Applications	KW	Grant Requests
GEF Project Spreadsheet (includes projects before the online portal began)	Approved	Approved for Payment	77	646.68	\$639,925.75
GEF Project Spreadsheet (includes projects before the online portal began)	Approved	Not started	92	755.33	\$759,728.50
GEF Project Spreadsheet (includes projects before the online portal began)	Approved by DNREC staff	In process	8	53.8	\$56,475.00
Online portal	Submitted; not reviewed by anyone; no GEF number assigned	Not started	59	415.22	\$270,617.00
Online portal	Reviewed by portal staff; not reviewed by DNREC staff; need information; no GEF number assigned	Not started	24	167.3	\$111,921.50
Online portal	Reviewed by portal staff, not reviewed by DNREC staff; no GEF number assigned	Not started	331	2,467.70	\$1,569,150.00
Online portal	Verified by DNREC staff	Need information	12	101.83	\$62,280.75
Online portal	Verified by DNREC staff	Reviewed	38	326.66	\$194,963.00
Online portal	Verified by DNREC staff	Step 5	37	357.72	\$203,346.62
Totals			678	5,292.24	\$3,868,408.12

Source: DNREC provided GEF project tracking spreadsheets and on-line application portal spreadsheets dated March 11, 2015

If all the projects listed above for which grant incentive requests have been submitted are completed, it would take approximately 2 1/2 years to pay all the grant reservation requests from the fund. This calculation assumes an expenditure of approximately \$125,000 per month based

on a 12 month allocation of \$1.5 million for residential projects. Further, from the pipeline shown in **Table 15**, more than 5 MW of solar could be added to total megawatts installed.

Administrative Provisions. The Delaware Administrative Code, upon approval by the Controller General, annually allows unobligated funds apportioned to the commercial sector in the Green Energy Endowment Program to be allocated subsequently for use in the residential sector. This practice allows the Energy Office to satisfy application queues, should they develop.

Previous Experience with Delayed-Payment Queues. The GEF previously had a delayed-payment queue and used American Recovery and Reinvestment Act (ARRA) funding to offer a faster payment option for projects that had completed at least \$500 of the energy efficiency measures identified in the audit. By encouraging “efficiency first” with solar projects, the GEF could issue payments for the solar grant incentive from the ARRA funds.

Other states, such as Maryland and New Jersey, experienced delayed-payment queues. Each was able to use additional funding to satisfy requests in the queue. Maryland used a new funding source, the Strategic Energy Investment Funds, to supplement the existing budget. Maryland then reduced the grant incentive for both commercial and residential systems by 50 percent to avoid future delayed-payment queues. New Jersey diverted funds from other programs that used the same funding source. In addition, the New Jersey Board of Public Utilities issued an order to stop accepting grant incentive applications for residential and commercial systems on December 20, 2007, and closed the Customer On-Site Renewable Energy (CORE) program. As of November 30, 2007, the program administrator reported that more than \$120.5 million in grant applications would remain in the queue after all of the remaining funding was committed. The funding level for 2008 for new incentives would have been \$102 million for the entire renewable energy portion of the Clean Energy Program. The Board Order diverted these funds to satisfy the queue, and diverted additional funding from the energy efficiency programs. A new program, the Renewable Energy Incentive Program (REIP) started accepting applications on February 3, 2009, with new program requirements and significantly reduced incentives, as shown in **Table 16**.

Table 16: New Jersey incentive change from CORE to REIP

Program	Start date	End date	Market	Incentive Per Watt					Max System Size	Max Incentive
				Up to 10kW	>10-50kW	>50-100 kW	>100-500 kW	>500 - 750 kW		
CORE	March 15, 2006	Dec. 20, 2007	Res	\$3.50					None	\$38,000
CORE	March 15, 2006	Dec. 20, 2007	Non-res	\$3.50	\$2.50	\$2.25	\$2.00	\$1.75	2MW	\$2 Million

Program	Start date	End date	Market	Incentive Per Watt					Max System Size	Max Incentive
				Up to 10kW	>10-50kW	>50-100 kW	>100-500 kW	>500 - 750 kW		
REIP	Feb, 3, 2009	Dec. 31, 2009	Res	\$1.55					None	\$17,500
REIP	Feb, 3, 2009	Dec. 31, 2009	Non-res & res PPAs	\$1.00	\$1.00				<50 kW	\$50,000

Source: NJCEP website – www.njcep.com

Incentive Levels / Economic Returns. Project analysis involved two different economic analysis methods: net present value and cash flow. Net present value (NPV) analysis indicated that the current incentives are much higher than available budgets can sustain, and ratepayers might be paying a higher cost than necessary to reach the desired RPS targets. We chose the net present value of the solar PV system as the criterion for comparison among scenarios. NPV reflects the multi-year value of the system to the customer or to the PPA and lease companies. The goal of an incentive program should be to keep the NPV of the system above zero, so that customers see a positive return on their investment. We considered four ownership and financing scenarios: (1) residential ownership; (2) commercial ownership; (3) residential PPA / lease (PPA / lease company perspectives); and (4) residential PPA / lease (homeowner perspective).

The NPV calculations are presented in **Table 6**.

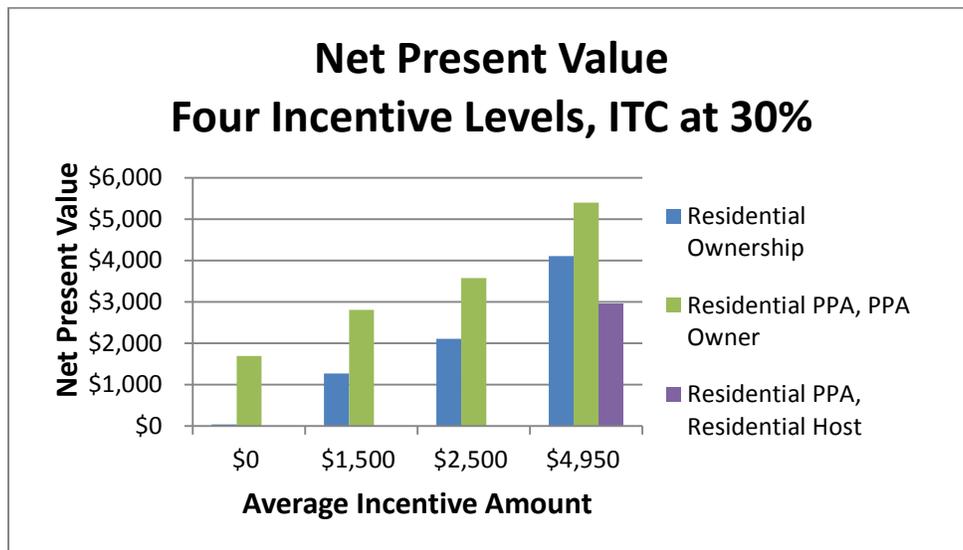
Table 6. Customer economic analysis, in terms of NPV, with the prevailing investment tax credit in effect until December 31, 2016

		System Owner Perspective			Residential Host Perspective*
		Residential Ownership	Commercial Ownership	PPA / Lease Company Ownership	PPA / Lease Company Ownership
Incentive		NPV after tax			NPV after tax
ITC at 30%	\$0	\$42	\$699	\$1,692	<i>Depends on resulting adjustments to PPA rates and lease monthly fees, if necessary</i>
	\$1,500	\$1,269	\$3,945	\$2,811	
	\$2,500	\$2,108	\$6,165	\$3,576	
	\$4,950 / \$9,725	\$4,110	\$11,461	\$5,401	

***Stakeholders indicated that monthly lease payments / PPA payments are very similar; they are treated as one and the same in this analysis.**

As **Table 6** and **Figure 2** show, the NPV analysis indicates positive returns from much lower grant incentives, especially with the commercial and PPA / lease company ownership. Additionally, the stakeholders indicated that a published declining incentive schedule would be very important for their future planning. Detailed stakeholder engagement questions and answers can be found in Appendix A.

Figure 2: NPV for solar PV using four different incentive levels



Program Implementation. The GEF program requirements currently utilize a two-step application process. In the first step, owners must request a grant reservation. Once the grant reservation application package is complete, the Department processes the reservation, and issues a Confirmation and Claim Form to the applicant. As long as the project follows the program rules, GEF staff receives and approves the completed paperwork and issue a project incentive shortly thereafter. With the current delayed-payment queue for residential projects, and the increase in PPA / lease projects indicating the grant incentive no longer is going to the resident, this reassurance has become less valuable.

By comparison, Maryland uses a one-step approach for residential systems. Program staff receives a project completion package after the system is fully installed and interconnected by the utility. According to Maryland Energy Administration staff, this has reduced the administrative burden for program staff, installers, and PPA / leasing companies, compared to a two-step process.

System Inspections. The DNREC program staff plans to conduct on-site quality assurance inspections for approximately 10% of systems installed. However, this goal often has not been achieved due to the application volumes and program staff time constraints. Maryland does not provide onsite inspections. However, New Jersey had required 100% inspections at the beginning of the program, and is now inspecting approximately 10% of the systems installed.

Energy Audits. The GEF program requirements include applicants to perform an energy audit or ENERGY STAR[®] Home certification. Stakeholders expressed concern that requiring an audit without also requiring performing the measures adds expense, increases paperwork for the application process, and results in delays in completing the application. Any changes to the requirement for an energy audit would require a legislative change. The New Jersey Clean Energy Program in the past provided added incentives for owners to complete energy efficiency audits and to install energy efficiency measures.

Electronic Signatures. The GEF does not currently allow electronic signatures on paperwork. Electronic signatures are a common practice in the industry. Stakeholders noted they believe electronic signatures provide more protection against fraud than a “wet” signature.

Interconnection Approval. Due to the high volume of solar PV projects, DPL is reported to be experiencing delays in processing interconnection requests. Stakeholders indicated that interconnection can take up to 100 days from the date they submit the second part of the interconnection agreement until they receive interconnection approval.

Recommendations: Achieving Long-Term Program Goals

To achieve program goals across the long term, DNREC has three essential options for moving forward in the short term:

1. **Seek and obtain new fulfillment funding.** The infusion of new and additional funding could enable DNREC to meet obligations in the delayed-payment queue and in the queue of submitted grant requests. Concurrently, DNREC could modify incentive levels for new applications to help funding go further in meeting increased market demand.
2. **Place a hold on receiving new applications, and develop a plan for fulfilling payments on applications already received.** DNREC could suspend the acceptance of new applications to the GEF, especially for the residential sector where a queue currently exists. Concurrently, it could put a plan in place that would allow the GEF to continue to pay out on existing, qualified (and submitted) projects from monthly funds across the next two to three years.
3. **The hybrid solution.** Elements from each of the two other options could be combined to allow for continued program growth at a lower ratepayer cost. This combination might involve finding new funding, implementing changes to the GEF, and making changes to the program requirements to help stakeholders most at risk with Option 2.

Option 1 – Seek and Obtain Additional Funding

Advantages of This Approach

- It satisfies stakeholders’ desires to be paid their expected incentives in a timely way for work already completed.
- It continues residential market growth toward satisfying Delaware’s Renewable Portfolio Standard (RPS) requirements and the solar carve-out in the RPS.
- It does not disrupt economic conditions for stakeholders who are currently supporting the Delaware residential solar market.
- It sets a precedent for allowing future funding for new projects at lower incentives, and therefore lowers the cost to ratepayers.
- It avoids possible lawsuits, because stakeholders’ expectations are met within the current structure of the published GEF rules.

Disadvantages of This Approach

- Finding new funding can be difficult if no ready sources are within reach in the short term.
- If the funding source is found from within State government and is reallocated to this activity, other valuable state programs might suffer, thus creating an opportunity for a negative public reaction.

Option 2 – Put GEF on Hold from Accepting New Applications

Advantages of This Approach

- It does not require the diversion of having to seek a new funding source.
- Without an influx of new applications, DNREC staff will be able to review and process existing applications, and not have a growing backlog.
- It allows the GEF to “buy time” for future planning, while also retiring the current pipeline of applications.

Disadvantages of This Approach

- Stakeholders—especially for the residential-owned projects—could be financially liable for loan re-payments they are not able to pay without receiving the incentive in a timely fashion.
- Lawsuits are possible as stakeholders lose their confidence in the GEF.
- Growth of solar in the residential market could stall, and thus contribute less to meeting the requirements of the RPS and its solar carve-out.
- Disrupt economic conditions for stakeholders who are currently supporting the Delaware residential solar market.
- Inquiries from dissatisfied stakeholders could result in higher costs to ratepayers if time and money are dedicated to answering claims.

Option 3 – A Hybrid Solution and Changes to the GEF

The advantages and disadvantages of a hybrid solution would be similar to the two options discussed above. Below are some additional changes that could help to minimize the disadvantages stated for Option 1 and Option 2.

- **Seek some new funding to meet obligations in the delayed-payment queue.** Any additional funding would help to reduce the current timeline of the existing delayed-payment queue.
- **Place a temporary hold on the GEF in receiving and accepting new applications, especially residential applications.** This would stop the delayed-payment queue from growing, and allow DNREC to obtain stakeholder input on proposed changes to the incentive levels and program requirements.
- **Immediately refine the residential pool by allocating 30 percent of its funds for residential ownership projects.** Currently approximately 23 percent of the residential solar PV projects are resident-owned. However, there are a significant number of geothermal systems that also would be funded from this pool.
- **Use the “unexpended funds provision” in the Delaware Administrative Code for the GEF.** Additional projects in the residential pool could receive funding from the non-residential funding pool to reduce some of the backlog. This strategy requires approval from Division and Department leadership, and from the State of Delaware Comptroller General.
- **Absent further refinement in the residential pool, treat residential PPA / leasing projects as non-residential projects.** The companies that are the owners of these systems are commercial entities. Even though PV systems are being placed on residences, this is a commercial business transaction. PPA / lease companies reap the same financial benefits (Investment Tax Credit (ITC) and depreciation, for example) that a commercial PV system owner would reap. Funding in the residential pool would then be allocated only for residential-owner projects, enabling fewer “draws” on the pool. In short, these projects could and would be paid more quickly. PPA / leasing companies typically have access to credit, and thus large delayed-payment queues are not a major concern. However, since the residential PPAs will drain the non-residential pool of funds quickly, provisions would be necessary for setting aside a small pool for nonprofit projects, or to allow nonprofit projects to be moved to the head of the queue. Owners of nonprofit projects cannot take advantage of the depreciation and the ITC, and therefore, quick incentive payments are critically important for their program participation. It is important to note, however, that treating residential PPA / leasing projects as non-residential is not consistent with the current definition of non-residential as listed in the Delaware administrative code. Implementing this recommendation would therefore require a legislative change.

- **Consider implementing budgets and allocating funding for projects once the Grant Reservation Request has been reviewed and approved by DNREC staff.** Applications would be accepted until the budget was met for the year. This strategy would require changes to the GEF. There may be some drawbacks to implementing this approach if a one-step application process is a future priority for the Department.
- **Discuss the delayed-payment queue issues with the stakeholders that are helping expand the Delaware market and encourage them to help craft the solution.** At the outset, these discussions could involve suggesting a lower incentive for projects they have submitted, but which have not yet been reviewed by the DNREC staff. If projects that have not yet been reviewed could receive a lower incentive, that alone could significantly shorten the delayed-payment queue. This process could start with a survey to gather stakeholder input. A draft proposal of recommendations could be presented during a periodic stakeholder meeting. A comment period could be implemented for feedback on the proposed recommendations. The NPV analysis could be used to determine lower incentive rates that still provide positive returns for the solar projects. More than 50 percent of the projects submitted fall in this category. Approximately 75 percent of the projects submitted to the queue are for PPA / leasing systems, with the incentives being paid to the PPA / leasing company.

Advantages of These Proposed Changes

- It gives priority to stakeholders that have the most financial need to be paid incentives in a timely way.
- It continues residential market growth toward satisfying the RPS and the solar carve-out.
- It does not disrupt economic conditions for stakeholders who are currently supporting the Delaware residential solar market.
- It allows future funding for projects at lower incentives—and therefore at a lower cost to ratepayers.
- It may minimize the risk of lawsuits, since DNREC staff would engage stakeholders to create solutions that reduce the delayed-payment queue.

Disadvantages of These Proposed Changes

- It does not consider the search for new sources of funding, thus putting the chances for success at risk.
- The queue, although likely smaller, will still remain. Conversely, the queue could also be larger, depending on which recommendations are implemented.

Recommendations: Changing Incentive Levels

Provided that additional funding sources are identified and/or the existing queue has been significantly reduced through other methods discussed above, recommendations could include

the following changes to incentive levels once a decision is made to start accepting applications into the GEF:

- **Publish in advance a declining rebate structure** for residential, non-residential, and nonprofit projects, including reducing the maximum system size for grant incentive calculation to 8 kW for resident-owned (average system size), and offer a flat incentive for residential PPA / lease and small commercial systems up to 50 kW.
 - **Timing of first reduction.** Publish the first change after stakeholder engagement and substantial reductions are made to the delayed-payment queue. An application acceptance date could be on or about November 1, 2015.
 - **Timing of subsequent reductions.** Simultaneously publish a declining schedule to go into effect on March 1, 2016 and July 1, 2016.
- **Initial proposed recommended grant incentive changes:**
 - **Residential:**
 - **Resident-owned:** Reduce incentive slightly by \$0.75 for up to 5 kW and \$0.20 for the additional 3 kW. Maximum incentive would be \$4,350 per system. NPV would still be positive, since it is similar to the example in the NPV analysis. If the residential pool had 30% carved out for resident-owned systems, and if the average monthly residential pool was \$125,000, then approximately eight systems could get paid each month—or 96 installed systems per year.
 - **Residential PPA / lease:** Offer a flat incentive of \$2,500 per project. The NPV would still be positive, and similar to the resident-owned NPV for the same project. If the residential pool had 70% carved out for PPA / leased systems and the residential pool was \$125,000, then approximately 35 systems could be paid each month—or 420 installed systems per year. Consider adding a maximum entity cap per year as a measure to prevent too much of the available funding from going to any single entity.
 - **Non- residential:**
 - **Commercial:** Offer the same flat incentive of \$2,500 per project, and continue to cap the system size at 50 kW. The NPV would still be positive and similar to that of the residential PPA / leased system. Since only a few projects have been submitted in this pool each year, the current rebate structure makes it unlikely that the program will see much activity from commercial PV projects. For comparison, Maryland offers an incentive of \$0.06 per Watt, which equals \$3,000 for a 50 kW commercial system.

- **Nonprofit:** Reduce incentives slightly to \$1.50 per Watt for up to 5 kW, and then \$0.75 cents per Watt, up to a 50 kW system. The maximum incentive per project would be somewhat lower, from \$48,000 to \$41,250. These systems have no tax advantages, so the incentive is critical for the project to be built.

The annual “unexpended funds” provision could regularly assist in reducing the backlog in the residential pool.

Table 17 highlights possible recommendations for incentive levels using a declining schedule.

Table 17. Possible Recommended Incentive Levels

Start Date	End Date	Market	Incentive per Watt			System Size Restriction	Maximum Incentive
			0 -5 kW	5 – 10 kW	10- 50 kW		
July 1, 2014	*June 15, 2015	Resident - owned	\$0.85	\$0.25	\$0.25	< 50 kW	\$15,000
		Residential PPA / lease	\$0.85	\$0.25	\$0.25	< 50 kW	\$15,000
		Non-residential	\$0.85	\$0.25	\$0.25	< 50 kW	\$24,000
		Nonprofit	\$1.75	\$1.00	\$1.00	< 50 kW	\$48,000
** November 1, 2015	February 28, 2016	Resident-owned	\$0.75	\$0.20	\$0.0	8 kW or less	\$4,250
		Residential PPA / lease	\$2,500 per project – flat incentive			< 50 kW	\$2,500
		Non-residential	\$2,500 per project – flat incentive			< 50 kW	\$2,500
		Nonprofit	\$1.50	\$0.75	\$0.75	< 50 kW	\$41,250
March 1, 2016	June 30, 2016	Resident - owned	\$0.60	\$0.20	\$0.0	8 kW or less	\$3,600
		Residential PPA / lease	\$1,500 per project – flat incentive			< 50 kW	\$1,500
		Non-residential	\$1,500 per project flat incentive			< 50 kW	\$1,500
		Nonprofit	\$1.25	\$0.50	\$0.50	< 50 kW	\$28,750

Start Date	End Date	Market	Incentive per Watt			System Size Restriction	Maximum Incentive
			0 -5 kW	5 - 10 kW	10- 50 kW		
July 1, 2016	October 30, 2016	Resident - owned	\$0.50	\$0.20	\$0.0	8 kW or less	\$3.100
		Residential PPA / lease	\$1,000 per project flat incentive			< 50 kW	\$1,000
		Non-residential	\$1,000 per project – flat incentive			< 50 kW	\$1,000
		Nonprofit	\$.75	\$0.50	\$0.50	< 50 kW	\$26,500

*This date is approximate based upon when DNREC announces a temporary hold on applications

**This date is approximate but should occur after stakeholder engagement and substantial reductions are made to the delayed-payment queue

Recommendations: Process and Paperwork Changes

- **Adopt a one-step paperwork process for the residential program.** The project will no longer require pre-approval for an incentive. However, if there is specific, allocated funding for residential-owned and for PPA / leased systems, it would reduce the risk of money not being available in a timely way for payments on completed projects. Other provision of this recommendation: The request package must be submitted within six months of installation. The required documentation could be what is currently required in the final documentation package, with a few of the items required in the grant request applications. Recommended paperwork could include:
 - Completed grant application in the name of the eligible applicant
 - Copy of a project contract, including the project cost
 - Plot diagram
 - Shading analysis
 - Copy of Home or Commercial Facility Energy Audit (**Existing Construction Only**)
 - Online State Substitute W-9 Form (<https://w9.accounting.delaware.gov/W9form.aspx>)
 - Home ENERGY STAR® Certification or Commercial ENERGY STAR Certification (**new construction only**)
 - Copy of Final Interconnection Approval
 - Copy if Final Sales Invoice(s) –including the warranties
 - Copy of Renewable System Photo (one of each system or array if multiple systems or arrays)

- Copy of verification of completion of installation, signed by customer and contractor
- Other suggested process or paperwork changes:
 - Allow the use of electronic signatures on the paperwork.
 - No longer require the Energy Audit. This could be helpful to installers and PPA / lease providers, since they are often burdened with the cost of the audit. Stakeholders expressed concern that requiring an audit without the focus on installing the recommended measures just adds more expense and additional paperwork to the application process, and delays completing the application. However, any changes to the requirement would need legislative approval. A better option might therefore be to provide added incentives for completing energy efficiency audits and for implementing the recommended energy efficiency measures.
 - More inspection by DNREC would provide on-site quality assurance for the program. It would be important to inspect an agreed-upon percentage of the systems installed each year.
 - Limit grants incentives to systems that install only within the program's eligibility requirements. Provide no grant for projects that are installed outside program requirements for shading, tilt and/ or orientation, rather than pro-rating the incentive.

Recommendations: Longer-Term Changes

- Need to determine how to make the solar renewable energy credit (SREC) market more market driven, so that the prices are more in line with what is needed for the market to grow without incentives. Low SREC prices result in a larger dependency on grant incentives for this market.
- Monitor changes in the Investment Tax Credit (ITC) in general. Lower credits could significantly affect solar development overall in Delaware and in other states.

Appendix A: Stakeholder Input

The following stakeholders provided input to this report:

- **Dale Davis**, President, CMI Solar Electric
- **Chris Ercoli**, Deputy Director of Policy & Electric Markets, Solar City
- **Emily Fik**, Customer Consultant, Go Liberty Solar
- **Jackie Johnson**, Office Manager, KW Solar Solutions
- **Erick Karlen**, Sr. Regulatory Specialist, Sungevity
- **Daniel LaCivita**, Manager - Training and Compliance, Dassault Aircraft Services
- **Scott Lynch**, Energy Services Manager, DEMEC
- **Finn McCabe**, Regulatory Affairs, Flexera
- **Russell Pfaller**, Installation Manager, Green Street Solar
- **Victor Poon**, Finance Analyst, Sungevity
- **David Stokes**, President, Marketing and Sales, Liberty Services Company
- **Robert Wevodau**, Technical Services, KW Solar Solutions
- **Dale Wolf**, President, KW Solar Solutions

At the end of the Project Kickoff webinar on January 27, 2015, an on-line survey was presented to participants. Nine participants responded to the survey with that results identified below:

1. **What are barriers to market development in Delaware now and in the future?**

(choose top 3 or 4 answers that currently affect you the most)

- Lease / PPA / ownership confusion (7 responses)
- Federal tax incentive going away (6 responses)
- Low SREC prices (6 responses)
- Large queue for the GEF (5 responses)
- Getting permits and other approvals (3 responses)
- Lack of clarity in future of GEF program strategy and or incentives (2 responses)
- Challenging program requirements (1 response)

2. **What do you think are effective strategies for program modifications to ensure the program is operating efficiently and the funds are being utilized to the maximum extent possible?**

(choose the top 3 or 4 answers that you think will provide program stability)

- Publish in advance a declining rebate structure for PPA / lease projects versus resident-owned projects (7 responses)

- Publish in advance a declining rebate structure based upon capacity blocks (4 responses)
 - Reduce the maximum system size for rebate calculation and participation in rebates (2 responses)
 - Require in addition to the completing the energy efficiency audit, completion of energy efficiency measures identified in the audit (1 response)
3. **What segments or markets if any are currently not participating in the GEF and what would help them participate?** (For example: low-income, certain non-residential segments, public, etc.)
- Low to medium income are not participating, in order for more participation this segment would need higher grants and guaranteed financing programs (for example: a state program to finance solar with lower interest rates even for those that have higher credit scores) (4 responses)
 - Utility funded community solar are not participating (2 responses)
 - Non- profit organizations such as churches and VFW's are not participating (1 response)
 - Non DPL customers are not participating in the Delaware solar market, in order for more participation there would need to be equalization of rebates across all Delaware utilities (1 response)
4. **What current or future trends do you see in the solar market that could affect program stability?** (For example: areas of new opportunities for growth in the Delaware market, new types of stakeholders entering the market, etc.)
- The over incentivizing of residential PPA / leases coupled with lack of full financial disclosure is causing the market for resident -owned systems to shrink (4 responses)
 - There are no clear program guidelines on PPA / lease repossessions, and if the installation must be registered as an easement on the property (1 response)
 - The inclusion of non-licensed installers on the approved contractor's list gives an unfair advantage to companies not willing to make the investment in their workforce (1 response)
 - The utility rate increases on demand side (KW) rather than volumetric (kWh) side bill negatively impact payback on medium -sized commercial projects (1 response)
5. **Do you have any other suggestions on how to maintain program sustainability with the current market conditions?** (Please include in the question any suggestions on program modifications or barriers)

- Exclude PPA / lease companies from receiving grant incentives in the GEF (6 responses)
- Reduce the existing rebate – suggestions include immediately capping the grant at \$1,000 (2 responses)
- Fund PPA / lease systems at a much lower incentive than resident -owned systems – suggestions include treating the residential PPA / lease systems as commercial systems (4 responses)
- Take funds from the GEF into stabilizing the SREC market (1 response)
- Have customers sign a document which explains the fundamental differences and benefits of PPA / leasing vs. owning a system (1 response)
- Down rate incentives for production or use base grant amounts on first year kwh savings, requiring a percentage of energy saving to accrue to maintain interconnection eligibility (2 responses)
- Use industry-standard tools for program administration, i.e. PowerClerk (1 response)
- Reduce paperwork requirements (1 response)
- Separate the queue for residential systems into two segments – owned systems verses PPA / lease systems – this would help reduce the wait time for receiving incentive payments for the resident- owned systems (1 response)

On February 18, 2015, staff members from five Delaware stakeholder firms were interviewed to obtain more input for the project. Results of the questions asked and answered during the interviews are presented below:

1. What are the benefits to your company by participating in the DPL Green Energy Fund?

- Installers stated that the GEF provides financial assistance to homeowners to help make a solar PV system purchase a viable project to invest in
- PPA / leasing companies stated that the incentive positively impacts their return on investment

2. What does your firm see as current barriers to market development in Delaware? Are barriers in Delaware better, same or worse to the other states that you work in?

- Long delays for the payment of incentives (4 responses)
- There is a lack of equity across utilities in Delaware, the incentives are different amongst utilities. Other states seem to be consistent with incentives for the utilities within that state (3 responses)
- Lack of transparency with the customer regarding the true costs and savings of a PPA / lease (3 responses)
- PPA / leases are perceived as a better option than purchasing (2 responses)

- Third party financing for the PPA projects in Delaware have a lower appraised value than other states due to the lack of a robust RPS and solar carve-out (1 response)
- There seems to be a number of projects that zero or low bid into the annual SREC auction. This causes a much lower SREC price (1 response)

3. What do you see as the barriers for the future?

- Federal Tax Credits going away (5 responses)
- Low SREC prices (4 responses)
- RPS and solar carve-out are not as aggressive as they should be (3 responses)
- Lack of low cost financing/direct loan model (1 response)

4. Based on available incentives and market conditions, do you consider the Green Energy Fund to offer customer financial returns for solar that are a) way below <25% below average, b) below 0-25% below average, c) average, d) above, e) way above. Can you compare and contrast to other states where you are working.

- All stakeholders shared that the grant incentive offered was above average but that the SREC incentive was below average thus creating overall average customer financial returns. Other states are offering lower or no grant incentives but higher SREC prices (5 responses)

5. What do you think are effective strategies for program modifications to ensure:

- a) sustained and orderly market growth**
- b) the program is operating efficiently**
- c) the funds are being utilized to the maximum extent possible**

- Create a published step down incentive structure (5 responses)
- Provide a more robust SREC market (4 responses)
- Simplify the incentive application process by providing a 1 step backend incentive (4 responses)
- Provide different incentives for residential PPA / lease projects vs. resident-owned projects (3 responses)
- Separate the residential funding into two segments – resident-owned and PPA / leasing (3 responses)
- Do not allow a zero bid for the SREC auction Create a minimum bid amount (2 responses)
- Treat PPA companies as commercial entities since they get to take advantage of the tax credits and depreciation. Pay incentives for their projects out of the non-residential bucket (1 response)
- Lower the system size caps on the incentives (1 response)

6. What are your experiences with these strategies? Have you experienced this in other markets?

- Other markets such as Maryland provide a streamlined, more efficient one-step backend incentive application process and no incentive for PPA / leased systems (5 responses)

7. Do you participate in the other solar programs in Delaware (municipal utility or the Delaware Coop programs)? If not why and if yes, what do you like or do not like about those programs?

- Most of the stakeholders shared that they have either no or little participation in these programs because the budgets are small and therefore can fund very few projects (5 responses)

8. In your customer transactions, who gets the benefit from the GEF incentive? Why is that the model you choose to work with?

- All stakeholders shared that for resident- owned systems the customer receives the incentive but for PPA / leased systems the PPA / lease company receives the incentive.

9. What type of contractual arrangement do you offer customers for the PV systems your company installs in Delaware?

- Purchase with financing option (term 12 months, 18 months, etc. sharing that many of the customers will utilize retirement funds, a home equity loan, or they will enter financing agreements that offer both a short term and long term agreement. The short term is for 12 months and allows them to pay the loan off with the federal tax credit and the GEF incentive. The long term loan would be for the rest of the payment.) (4 responses)
- Purchase (3 responses)
- Lease (terms of lease agreement) (3 responses – 20 year Lease)
- PPA (rate and length of agreement (2 responses – 20 year PPA)

10. In your customer transactions, who gets the benefit from the SREC? Why is that the model you choose to work with?

- All stakeholders shared that for resident - owned system the customer receives the SREC benefits but for PPA / leased systems the PPA / lease company receives the SREC benefits. It was shared that this model makes the most sense for the system owner.

11. For the SREC market, do your customers participate in the annual auction or the recent DE SEU SREC Purchase Grant Program? Why is that the path you chose?

- DE SEU SREC Purchase Grant Program – (4 responses)
- Annual auction (4 responses)

The stakeholders working with systems that are resident -owned share both options with the customer and allow them to choose. The PPA / lease companies tend to choose one option for all of their projects in Delaware.

12. What segments or markets if any, are currently not participating in the GEF and what would help them participate? (For example: low-income, certain non-residential segments, public, etc.)

- Low income (3 responses)
- Multifamily buildings (1 response)
- Non-profits (1 response)

13. What current or future trends do you see in the solar market that could affect program stability? (for example: areas of new opportunities for growth in the Delaware market, new types of stakeholders entering the market, etc., new leasing agreements, reduced business tax credits)

- Reduction of the federal tax credit will hurt participation in the solar market for participants (5 responses)

14. Do you have any other suggestions on how to design the program so that so the market continues to grow in a sustainable fashion that is beneficial for Delaware rate payers and economy given the current and emerging market conditions? (other than what you shared in question 5)

- Improve the SREC prices by increasing the solar carve-out requirement in the RPS (2 responses)

15. What are the challenges or frustrations with the GEF? (For example – application materials required, application submission process, turn-around time for incentive payments, quality control etc.)

- Large queue of completed projects waiting to be paid (5 responses)
- Energy audit requirement – it was shared that this was treated as program requirement only and most homeowners do not utilize the results and improve the energy efficiency of their home (3 responses)
- Delayed approval of the interconnection application by DPL (2 responses)
- Amount of paperwork required by the program (2 responses)
- Lack of a quality control inspection process (2 responses)
- Program does not allow electronic signatures (2 response)
- Additional fees required such as the PSC certification fee (1 response)

Appendix B: GEF Detailed Program Metrics – Grants Paid

	Non-residential		Resident-owned		Residential PPA / lease		Total	
Calendar Year Application Received	# of Grants	Grant Award Amount Paid	# of Grants	Grant Award Amount Paid	# of Grants	Grant Award Amount Paid	# of Grants	Grant Award Amount Paid
2002	3	\$873,278	2	\$14,282			5	\$887,560
2003	1	\$21,432	2	\$21,000			3	\$42,432
2004	2	\$77,920	2	\$42,518			4	\$120,438
2005	1	\$20,150	4	\$65,225			5	\$85,375
2006	6	\$748,215	32	\$598,502			38	\$1,346,717
2007	19	\$1,644,278	51	\$990,259			70	\$2,634,537
2008	31	\$3,064,983	184	\$4,198,103			215	\$7,263,086
2009	30	\$2,686,253	177	\$2,827,554			207	\$5,513,807
2010	43	\$3,197,520	129	\$1,257,153			172	\$4,454,489
2011	11	\$234,950	98	\$675,698	6	\$41,108	115	\$951,756
2012	9	\$142,775	142	\$985,075	14	\$90,326	165	\$1,218,176
2013	7	149,738	151	\$1,106,877	69	\$512,968	227	\$1,769,583
2014	11	\$71,573	160	\$869,689	108	\$508,743	279	\$1,450,005
2014 online portal	8	\$116,385	89	\$443,213	384	\$1,815,716	481	\$2,375,314
Total	181	\$12,870,118	1223	\$14,095,148	581	\$2,968,861	1986	\$30,113,275

Source: DNREC. Excludes cancelled and duplicate, but includes payments approved but in queue waiting to be paid. Includes all applications in online portal as of 12/31/14. Includes applications approved, payment pending for 2013 and 2014.

Appendix C: List of Inputs for the Analysis – Delaware

Inputs	Model PV Watts, <u>Resident-owned Perspective</u>	Source of value	Model PV Watts, <u>Commercial Owner Perspective</u>	Source of value	Model PV Watts, <u>PPA, Commercial Owner Perspective</u>	Source of value
Weather station	Dover Air Force Base	Chosen because of its central location in the state, although Wilmington receives ~5% more sun	Dover Air Force Base	Chosen because of its central location in the state, although Wilmington receives ~5% more sun	Dover Air Force Base	Chosen because of its central location in the state, although Wilmington receives ~5% more sun
System nameplate size (kWdc)	7.8	GEF data, average of last year	26.9	GEF data, average of last year	7.8	GEF data, average of last year
Inverter efficiency	96%	NREL default value in SAM tool	96%	NREL default value in SAM tool	96%	NREL default value in SAM tool
DC to AC ratio	1.1	NREL default value in SAM tool	1.1	NREL default value in SAM tool	1.1	NREL default value in SAM tool
Tilt	28.7	GEF data, online portal	30	GEF data, online portal	28.7	GEF data, online portal
Azimuth	191	GEF data, online portal	188	GEF data, online portal	191	GEF data, online portal
Total system losses (shade, soil on panels, etc.)	14.08%	NREL default value in SAM tool	14.08%	NREL default value in SAM tool	14.08%	NREL default value in SAM tool
Total Installed costs (\$/Wdc)	\$3.90	GEF data, average of last year	\$ 3.20	GEF data, average of last year	\$3.20	GEF data, average of last year
Total system cost	\$ 30,420.00	calculated	\$86,080.00	calculated	\$ 24,960.00	calculated

Inputs	Model PV Watts, <u>Resident-owned Perspective</u>	Source of value	Model PV Watts, <u>Commercial Owner Perspective</u>	Source of value	Model PV Watts, <u>PPA, Commercial Owner Perspective</u>	Source of value
O&M costs	20 \$/KW/yr for ownership, \$0 for PPA / lease	NREL default value in SAM tool, consistent with values commonly used, includes inverter replacement after ~15 years	20 \$/KW/yr for ownership, \$0 for PPA / lease	NREL default value in SAM tool, consistent with values commonly used, includes inverter replacement after ~15 years	20 \$/KW/yr for ownership, \$0 for PPA / lease	NREL default value in SAM tool, consistent with values commonly used, includes inverter replacement after ~15 years
Degradation rate of the solar system	0.50%	NREL default value in SAM tool	0.50%	NREL default value in SAM tool	0.50%	NREL default value in SAM tool
Loan type	mortgage	NREL default value in SAM tool	mortgage	NREL default value in SAM tool		
debt fraction	70%	Assumes buyer takes out a second loan to cover the incentives	70%	Assumes buyer takes out a second loan to cover the incentives	70%	Assumes buyer takes out a second loan to cover the incentives
loan term/ PPA term	15 years	professional judgment: reduced from NREL's default of 25 yrs	15 years	professional judgment: reduced from NREL's default of 25 yrs	15 years	professional judgment: reduced from NREL's default of 20 yrs
PPA / lease down payment	0					none of the sample lease and PPA had a down payment
loan rate	4%/ year for ownership	professional judgment: reduced from NREL's default of 5%	4%/ year for ownership	professional judgment: reduced from NREL's default of 5%	2%	professional judgment
analysis period	20 year	professional judgment: increased from NREL's default of 25 years	20 year	professional judgment: increased from NREL's default of 25 years	20 year	term of the lease, the PPA does not own the system after that

Inputs	Model PV Watts, Resident-owned Perspective	Source of value	Model PV Watts, Commercial Owner Perspective	Source of value	Model PV Watts, PPA, Commercial Owner Perspective	Source of value
PPA cost/kWh					\$ 0.13	national average for solar City: \$0.15 (http://www.greentechmedia.com/articles/read/SolarCitys-New-201M-Securitized-Solar-Portfolio-Keeps-the-Capital-Flowing)
PPA Price escalation					0	Sample PPA Proposals – used fixed PPA price for this example
inflation rate	2.5%/year	NREL default value in SAM tool	2.5%/year	NREL default value in SAM tool	2.5%/year	NREL default value in SAM tool
discount rate	3%/year	base case in "Study of Potential for Energy Savings in Delaware, 9/4/2014, DNREC) - reduced from NREL default value in SAM tool (5.2%), and value used in sample PPA agreements.	3%/year	base case in "Study of Potential for Energy Savings in Delaware, 9/4/2014, DNREC) - reduced from NREL default value in SAM tool (5.2%), and value used in sample PPA agreements.	3%/year	base case in "Study of Potential for Energy Savings in Delaware, 9/4/2014, DNREC) - reduced from NREL default value in SAM tool (5.2%), and value used in sample PPA agreements.
federal income tax rate	25%	NREL default value in SAM tool	25%	NREL default value in SAM tool	25%	NREL default value in SAM tool
state income tax rate	6.6%	taxfoundation.org	8.7%	taxfoundation.org, corporate income tax flat rate	8.7%	taxfoundation.org, corporate income tax flat rate
sales tax	0%	Delaware specific	0%	Delaware specific	0%	Delaware specific

Inputs	Model PV Watts, <u>Resident-owned Perspective</u>	Source of value	Model PV Watts, <u>Commercial Owner Perspective</u>	Source of value	Model PV Watts, <u>PPA, Commercial Owner Perspective</u>	Source of value
insurance rate (annual)	0.50%	NREL default value in SAM tool	0.50%	NREL default value in SAM tool	0.50%	NREL default value in SAM tool
property tax: assessed percentage	6%	Professional judgment	80%	Professional judgment	0%	installed at host site
property tax: annual decline	0%	NREL default value in SAM tool	0%	NREL default value in SAM tool	0%	installed at host site
Property tax rate	2%	NREL default value in SAM tool, general magnitude of values in "Delaware Property Tax Rates 2012-2013, DE Economic Development Office, http://delaware.gov/topics/TaxCenter "	2%	NREL default value in SAM tool	0%	installed at host site
salvage value at the end of system life	0%	NREL default value in SAM tool	0%	NREL default value in SAM tool	0%	NREL default value in SAM tool
Depreciation (commercial only)	N/A	N/A	5-yr MACRS for both federal and state	NREL default value in SAM tool	5-yr MACRS for both federal and state	NREL default value in SAM tool
Federal ITC	0% and 30%,	2 scenarios	10% and 30%	2 scenarios	10% and 30%	2 scenarios
Production Based Incentive (SREC)	\$450/kW	SEU grant	\$450/kW	SEU grant	\$450/kW	SEU grant

Inputs	Model PV Watts, <u>Resident-owned Perspective</u>	Source of value	Model PV Watts, <u>Commercial Owner Perspective</u>	Source of value	Model PV Watts, <u>PPA, Commercial Owner Perspective</u>	Source of value
SREC is taxable	yes, state and federal tax	debated, some argue that it is a subsidy and as such is not taxable, other argue that if it is a subsidy, then the ITC must, by law, be reduced by the amount of the subsidy.	yes, state and federal tax	debated, some argue that it is a subsidy and as such is not taxable, other argue that if it is a subsidy, then the ITC must, by law, be reduced by the amount of the subsidy.	yes, state and federal tax	debated, some argue that it is a subsidy and as such is not taxable, other argue that if it is a subsidy, then the ITC must, by law, be reduced by the amount of the subsidy.
Capacity Based incentive/ State incentive	\$ 0.63	varies from \$0 to current incentive level	vary from \$0 to current incentive level	continuous (<i>note for analysis: first 5 kw as fixed incentive and remaining 45 kW as \$/W, so that both can be varied in the sensitivity analysis</i>)	vary from \$0 to current incentive level	continuous (<i>note for analysis: first 5 kw as fixed incentive and remaining 45 kW as \$/W, so that both can be varied in the sensitivity analysis</i>)
State incentive is taxable	No	http://delcode.delaware.gov/title29/c080/sc02/index.shtml – section (f)	No	http://delcode.delaware.gov/title29/c080/sc02/index.shtml – section (f)	No	http://delcode.delaware.gov/title29/c080/sc02/index.shtml – section (f)
Electricity rate: net metering year end sale rate	\$ 0.088	Provided by Glenn Moore, Delmarva Power	\$ 0.044	Provided by Glenn Moore, Delmarva Power	\$ 0.088	Provided by Glenn Moore, Delmarva Power
Electricity rate: fixed monthly charge	\$11.71	Open EI: Delmarva Residential service (Bundled)	\$49.52	Open EI: Delmarva Power: Medium General Service - Secondary (Bundled)	\$11.71	Open EI: Delmarva Residential service (Bundled)

Inputs	Model PV Watts, <u>Resident-owned Perspective</u>	Source of value	Model PV Watts, <u>Commercial Owner Perspective</u>	Source of value	Model PV Watts, <u>PPA, Commercial Owner Perspective</u>	Source of value
Electricity rate:	\$0.12	Open EI: Delmarva Residential service (Bundled), confirmed by Glenn Moore, Delmarva Power	\$0.11	Provided by Glenn Moore, Delmarva Power	\$0.12	Open EI: Delmarva Residential service (Bundled), confirmed by Glenn Moore, Delmarva Power
Electricity cost escalation rate	2.5%/year	inflation rate (largest rate increased Delmarva had in the recent future was 5% in one year, but then they also had a hiatus with no rate increase too. Filing for rate increase takes more than one year, therefore we assumed a 5% increase every 2 years is reasonable)	2.5%/year	inflation rate (largest rate increased Delmarva had in the recent future was 5% in one year, but then they also had a hiatus with no rate increase too. Filing for rate increase takes more than one year, therefore we assumed a 5% increase every 2 years is reasonable)	2.5%/year	inflation rate (largest rate increased Delmarva had in the recent future was 5% in one year, but then they also had a hiatus with no rate increase too. Filing for rate increase takes more than one year, therefore we assumed a 5% increase every 2 years is reasonable)
household electric load	13,000 kWh	5,101 kWh per capita (http://apps1.eere.energy.gov/states/residential.cfm/state=DE) x 2.63 person per household (census) = 13,415 kWh	133,045 kWh	assumes that a 100 kW system would cover 100% of the load	13,000 kWh	5,101 kWh per capita (http://apps1.eere.energy.gov/states/residential.cfm/state=DE) x 2.63 person per household (census) = 13,415 kWh
household load growth rate	0%/year	NREL default value in SAM tool	0%/year	NREL default value in SAM tool	0%/year	NREL default value in SAM tool

Appendix D: List of Inputs for the Analysis – Maryland and New Jersey

Input	MD- Value	MD- Source of value	NJ- Value	NJ- Source of value
Weather station	Baltimore Blt-washngtn Int'l	Central location available in SAM tool	Mcguire Afb	Central location available in SAM tool
System nameplate size	7.8 kW	Analysis of MEA historical data (average of most recent year)	7.8 kW	Analysis of historical data (average of most recent year)
Total Installed costs	\$3.9/W	Analysis of MEA historical data	\$3.9/W	Analysis of historical data
state income tax rate	5. 5%	Married \$150-250,000, http://taxfoundation.org	6.37%	Married \$150-500,000, http://taxfoundation.org
sales tax	0%	Sales tax exemption	0%	Sales tax exemption
Property tax rate	0%	Property tax exemption for solar	2%	1.89% from http://www.tax-rates.org/new_jersey/property-tax
Production Based Incentive (SREC)	\$120/ MWh	Recent prices on www.srectrade.com	\$150/ MWh	http://www.njcleanenergy.com/srecpricing
SREC term	15 years	DSIRE database	15 years	http://www.njcleanenergy.com/srec
State Incentive	\$1,000 per project	MEA website	\$0	NJCEP website
Electricity rate: fixed monthly charge	7.75	Open EI rate for Potomac Edison	10	Professional judgment
Electricity rate:	0.13	Open EI rate for Potomac Edison, similar to data in EIA 2012	0.15	EIA data, 2012 (Data from forms EIA-861- schedules 4A-D, EIA-861S and EIA-861U)
household electric load (kWh)	13,000	EIA data, 2012 (Data from forms EIA-861- schedules 4A-D, EIA-861S and EIA-861U),	13,000	Load made to be slightly greater than the solar PV produces annually

Appendix E: Cash Flow Analysis

YR	Electric rate*	Electric bill before system	Electric bill after system	PPA rate	PPA annual cost	PPA: Total Expense	PPA: Cash Flow	PPA: Cumulative Savings	Owners after tax annual costs	After-tax value of energy generated by system	Owners: Cash Flow (after tax)	Owners Cumulative Savings
1	\$0.12	\$1,701	\$483	\$0.13	\$1,319	\$1,802	(\$101)	(\$101)	(\$2,829)**	\$1,205	(\$1,624)	(\$1,624)
2	\$0.12	\$1,740	\$492	\$0.13	\$1,319	\$1,811	(\$71)	(\$172)	(\$1,551)	\$1,259	(\$292)	(\$1,916)
3	\$0.13	\$1,779	\$500	\$0.13	\$1,319	\$1,819	(\$40)	(\$212)	(\$1,568)	\$1,315	(\$253)	(\$2,169)
4	\$0.13	\$1,820	\$509	\$0.13	\$1,319	\$1,828	(\$8)	(\$220)	(\$1,587)	\$1,374	(\$212)	(\$2,381)
5	\$0.13	\$1,862	\$519	\$0.13	\$1,319	\$1,838	\$25	(\$195)	(\$1,605)	\$1,436	(\$169)	(\$2,550)
6	\$0.14	\$1,906	\$528	\$0.13	\$1,319	\$1,847	\$59	(\$137)	(\$1,624)	\$1,500	(\$124)	(\$2,674)
7	\$0.14	\$1,950	\$538	\$0.13	\$1,319	\$1,857	\$93	(\$44)	(\$1,644)	\$1,567	(\$77)	(\$2,751)
8	\$0.14	\$1,995	\$548	\$0.13	\$1,319	\$1,867	\$128	\$85	(\$1,665)	\$1,637	(\$28)	(\$2,779)
9	\$0.15	\$2,041	\$558	\$0.13	\$1,319	\$1,877	\$164	\$249	(\$1,686)	\$1,711	\$24	(\$2,755)
10	\$0.15	\$2,089	\$568	\$0.13	\$1,319	\$1,887	\$202	\$450	(\$1,708)	\$1,787	\$79	(\$2,676)
11	\$0.15	\$2,137	\$579	\$0.13	\$1,319	\$1,898	\$240	\$690	(\$1,731)	\$1,867	\$136	(\$2,539)
12	\$0.16	\$2,187	\$590	\$0.13	\$1,319	\$1,909	\$278	\$969	(\$1,754)	\$1,951	\$196	(\$2,343)
13	\$0.16	\$2,239	\$601	\$0.13	\$1,319	\$1,920	\$318	\$1,287	(\$1,779)	\$2,038	\$259	(\$2,084)
14	\$0.17	\$2,291	\$613	\$0.13	\$1,319	\$1,932	\$359	\$1,646	(\$1,804)	\$2,129	\$325	(\$1,758)
15	\$0.17	\$2,345	\$625	\$0.13	\$1,319	\$1,943	\$401	\$2,048	(\$1,830)	\$2,225	\$395	(\$1,364)
16	\$0.17	\$2,400	\$637	\$0.13	\$1,319	\$1,956	\$444	\$2,492	(\$472)	\$2,324	\$1,852	\$489
17	\$0.18	\$2,456	\$649	\$0.13	\$1,319	\$1,968	\$488	\$2,980	(\$483)	\$2,428	\$1,945	\$2,434
18	\$0.18	\$2,514	\$662	\$0.13	\$1,319	\$1,981	\$534	\$3,514	(\$494)	\$2,537	\$2,042	\$4,476
19	\$0.19	\$2,574	\$675	\$0.13	\$1,319	\$1,994	\$580	\$4,094	(\$506)	\$2,650	\$2,144	\$6,620
20	\$0.19	\$2,634	\$688	\$0.13	\$1,319	\$2,007	\$627	\$4,721	(\$518)	\$2,769	\$2,251	\$8,871
							\$4,721				\$8,871	

*Increases based on US Energy Information Administration (EIA) Delaware residential retail electric rate data history, 2003 – 2014

**Includes system purchase price less the grants and tax incentives plus the first month's loan payment.