Memorandum

TO: The Honorable Mayor and Members of City Council
VIA: James E. Baker, City Manager
FROM: Jaleh M. Shea, AICP, Planning Director
DATE: July 28, 2017
SUBJECT: Solar Farms in Chesapeake

At its June 20, 2017 meeting, City Council requested staff to provide a comprehensive report on utility-scale solar energy facilities, or solar farms. Pursuant to that request, the report provided herein is intended to provide objective background information and policy recommendations to assist City Council in their review of conditional use permit applications for the development of utility-scale solar energy facilities on properties principally in the A-1, Agriculture district of rural Chesapeake. Residential and commercial applications of solar energy are not addressed in this report.

1. Overview of Solar Energy

There are three types of solar energy – thermal, photovoltaic, and concentrating. The focus of this report will be on photovoltaic (PV) solar energy, which converts solar energy into direct current electricity using photovoltaic solar cells. For reference, thermal solar converts solar energy into heat and is often used for water heating purposes. Concentrating solar uses a series of mirrors or lenses to focus sunlight into a small beam for heating a steam turbine, which powers an electrical generator.

Solar PV energy can be employed in a variety of applications, including residential, commercial, and utility-scale. Residential and commercial solar energy places a limited number of PV panels on rooftops or ground-mounted supports to provide power to a defined entity. Utility-scale solar energy, commonly referred to as solar farms, consists of a large array of ground-mounted PV panels that generate electricity that is then transferred to the power grid for sale and distribution.

The City of Chesapeake has numerous residential and commercial applications of solar energy, including a roof-top mounted system at Western Branch High School. The system at Western Branch High School required a conditional use permit (UP-15-35)
that was approved in 2015. Since then, the City has received four applications for a conditional use permit to allow solar farms on agriculturally zoned property. Details and the status of each application is provided below.

- **PLN-USE-2016-016 – Sun Energy-Williams Tract.** This application proposed a 20 megawatt (MW) solar farm on a 241 acre parcel located at 4829 Ballahack Road. The Planning Commission held a public hearing on June 8, 2016 at which time the application was recommended for approval with stipulations. City Council held a public hearing on September 27, 2016 at which time the application was denied.

- **PLN-USE-2017-001 – TWE Chesapeake Solar Project, LLC.** This application proposes a 20 MW solar farm on a 176 acre parcel located approximately one-half mile northwest of the intersection of Head of River Road and Long Ridge Road. The Planning Commission held a public hearing on May 10, 2017 at which time the application was continued to the August 9, 2017 Planning Commission meeting.

- **PLN-USE-2017-002 – Centreville Pike Solar Project, LLC.** This application proposes a 15 MW solar farm on a 245 acre parcel located at 58 Centerville Turnpike South. The Planning Commission held a public hearing on May 10, 2017 at which time the application was continued to the August 9, 2017 Planning Commission meeting.

- **PLN-USE-2017-003 – New Energy Ventures Hickory Solar Farm.** This application proposes a 32 MW solar farm on a 154 acre parcel located northeast of Ballentine Rd. and 4,074 ft. east of Battlefield Blvd. The Planning Commission held a public hearing on May 10, 2017 at which time the application was recommended for approval with stipulations and will be heard at the August 15, 2017 City Council meeting.

2. **Common Concerns**

The following subsections address some of the commonly cited concerns and issues related to solar farms in Chesapeake.

2.1. Human Health and Safety

A recent report published by the North Carolina State University’s NC Clean Energy Technology Center (Attachment 1) thoroughly addresses the health and safety impacts of solar PV panels. Specifically, the report addresses the issues of hazardous materials, electromagnetic fields, electric shock and arc flash, and fire safety. A summary of the findings presented in the report is below.

**Hazardous Materials**

PV panels used in residential, commercial, and utility-scale applications use one of three types of panel technology – crystalline silicon, cadmium telluride, or copper indium gallium selenide. Each type of panel technology generates electricity, but
with varying degrees of efficiency, longevity, and reliability. The most commonly used technology is crystalline silicon, which accounts for 90% of solar PV panels installed today and will be used in the Hickory Solar Farm (PLN-USE-2017-003) and likely all other solar farms proposed in Chesapeake. Crystalline silicon is used for the semi-conductors on the panels, which convert sunlight to electricity, and account for a very small percentage of the overall panel weight. Well over 80% (by weight) of the panel is glass and aluminum. A small amount of lead may also be used in the electrical solder, but this is increasingly being replaced with lead-free solder. Crystalline silicon PV panels do not pose a material risk of toxicity to public health and safety.¹

Additionally, when PV panels reach the end of their useful life, they can be disposed of in a landfill or recycled. Studies prove there is no leaching concerns associated with landfill disposal of the panels and due to the material composition of PV panels, recycling is increasingly viable. A national recycling program exists and analysis has found that current salvage value of solar farm equipment generally exceeds general contractor estimates for the cost to remove all equipment.²

Operations and maintenance of solar farms includes infrequent washing of the PV panels with soap and water and regular maintenance of on-site vegetation. To maintain vegetation around ground-mounted panels, mowing and weed eating of ground cover is conducted at an interval dependent upon the season. Common herbicide, such as 2-4-D and glyphosate (i.e., Round-up), is also typically used in strategic locations of a solar farm, including around perimeter fencing, interior roads, and at the base of panel support posts.

*Electromagnetic Fields*

An electric generating facility, such as a solar farm, generates electromagnetic fields (EMF), also known as radiation. The type of EMF generated by electricity is non-ionizing radiation, low energy, and does not damage DNA. Research has documented that the strength of EMF present at the perimeter of a solar farm is significantly lower than the typical American’s average EMF exposure and well-below the level at which EMF interference is tested.

*Electric Shock and Arc Flash Hazards*

Electric shock and arc flash are threats to anyone entering any electrical cabinets or in close proximity to equipment during a short circuit situation. All equipment for a solar farm is installed, tested, and repaired by properly trained and equipped technicians and electricians. The National Electric Code requires warning signs on all electric components and that the site be secured from unauthorized visitors with

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fencing and additional signage. In addition, installed equipment on a solar farm would be inspected and approved by City building inspectors in the Department of Development and Permits.

Fire Safety

A small portion of materials in PV panels are flammable, but those components cannot self-support a fire. Heat from a small flame is not adequate to ignite a PV panel. Heat from a more intense fire or energy from an electrical fault can ignite a panel, but examples of this are extremely rare. Improved understanding of specific PV panel risks, safe system designs, and updated fire-related codes and standards will continue to reduce the risk of fire caused by solar farms.

2.2. Wildlife and Habitat

The primary impact to wildlife and habitat is due to land occupation by the solar farm itself and is correlated to the biodiversity of the land on which the facility is built. Since the proposed solar farm projects in Chesapeake are located on previously cleared and drained agricultural land, the biodiversity of the site is already diminished. However, there are foreseeable impacts to wildlife that may result from a solar farm. One such impact is the restriction of wildlife movement and migration patterns due to perimeter fencing around the site that creates an impenetrable area for ground-based wildlife. Due to the relatively small size of projects proposed in Chesapeake (<250 acres on average) and the fact they are proposed in existing open, agricultural areas, a significant impact to wildlife movement and migration patterns is not likely. Another possible impact on wildlife is the appearance of the reflective PV panel surface as a body of water, possibly causing death and injuries to birds colliding with panels. However, research demonstrates this is more common with concentrating solar facilities, which use highly reflective mirror panels. Design characteristics of PV panels attempt to reduce reflection to the greatest extent possible in order to generate electricity efficiently.

Due to the fact that solar farms are being proposed on cleared agricultural lands, there may be an opportunity for habitat enhancement with the strategic use of groundcover and management practices that benefit pollinators and ground nesting species. Additionally, such practices could restore soil health and help make the site more productive for agriculture upon decommissioning.

2.3. Aesthetics

Solar farms use ground-mounted panels that are low-profile and do not typically exceed 10 feet in height. Without screening of any kind, rows of solar panels and associated equipment are easily viewable through perimeter fencing. Depending on the orientation of the site, adjacent land uses, and nearby public rights-of-way, the

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solar farm may or may not be visible to adjacent landowners or the traveling public. Solar farms can successfully be screened out of view using berms and vegetation. The lack of topographic relief in Chesapeake makes these techniques especially effective. Berms are typically 6 to 8 feet in height, planted with grasses, and situated outside the perimeter fencing. Vegetation, including a variety of trees and shrubs, are then planted in front of the berm to further screen the site.

2.4. Noise

Temporary elevated noise levels can be expected during the construction phase of a solar farm from truck and vehicle traffic, earth-moving equipment, and other construction equipment or infrastructure. The duration of the construction phase is dependent upon the generating capacity of the solar farm and generally ranges from 6 months to one year. During this period, the site is an active construction zone and noise can result and emanate off the site, particularly from the driving of posts into the ground for panel mounting.

Once construction is complete, an operating solar farm generates minimal noise. The primary noise emanating from a solar farm is from inverters, equipment that converts the DC current from the PV panels into AC current for the electric grid, during generating (daylight) hours. The electrical humming that inverters emit is at a level similar to that of a residential air conditioner unit. Sound may also come from transformers and cooling fans, depending on the generating capacity of the site and how it is connected to the electrical network. The solar PV panels themselves do not emit any sound. Inverters are typically located in a central location relative to the PV panels they support and away from the perimeter of the site. As a result, sound beyond the site is rarely audible. In addition, screening methods used to reduce the visual impact of a solar farm have the additional benefit of also reducing sound.

2.5. Glare

Glare and reflection reduce the effectiveness of PV panels to generate electricity, so panels are designed to absorb as much sunlight as possible. The Large-Scale Model Solar Ordinance developed by the Virginia Department of Environmental Quality states “that solar technologies that can realistically be utilized in Virginia do not create glint or glare problems.” However, due to the surface material and coatings, PV panels can be moderately reflective at certain angles, similar to water or other glass surfaces. Screening methods used to reduce the visual impact of a solar farm will greatly reduce any glare visible from adjacent properties.

The Federal Aviation Administration’s Interim Solar Policy, which has been adopted by the U.S. Department of Defense, provides methods for assessing glare and standards for determining impact for solar farm projects on airport property. The Centreville Pike Solar Project (PLN-USE-2017-002), located southwest of Naval Auxiliary Landing Field Fentress, voluntarily submitted a Glint/Glare Study that adheres to the FAA’s Interim Solar Policy. The results of the study, conducted by an
independent firm, found that no glare is recorded from the project as proposed. It is also prudent to note that Naval Air Station Oceana is in the process of developing a solar farm on Federal property south of the runway that is expected to be operational in late 2017.

2.6. Weather

Ground-mounted PV panels, such as those proposed in Chesapeake, are designed to withstand most extreme weather conditions, such as high winds and hail, and impact from airborne debris. The aluminum casing around interior components gives the PV panel its strength and is attached directly to the mounting mechanism. If high winds are predicted, the solar farm is typically taken off line and, if mounted on a rotating axis, the panels are rotated to a position that minimizes drag. Heavy precipitation events serve to clean the panels and do not impact system operation. Solar farms are also designed with lightning protection on all system components in order to avoid damage in the event of a direct lighting strike. Additionally, the solar arrays are considered a structure by the Virginia Uniform Statewide Building Code and required to meet all applicable building safety standards.

2.7. Land Use

Solar farms in Chesapeake are typically located on land that is zoned A-1, Agriculture, within the Rural Overlay District, and used for agricultural purposes, specifically the growing of the commodity crops such as corn, wheat, and soybeans. Development of a solar farm removes land from traditional agricultural production and is therefore considered a change of land use. To permit this change of use, a conditional use permit is required per the Chesapeake Zoning Ordinance. Additional information regarding the local permitting process can be found in a subsequent section of this report.

The City’s Comprehensive Plan values agricultural preservation and supports the continued use of rural lands for agricultural purposes. Goal 2 of Chapter 4 of the Plan promotes the unique character of each of the City’s three overlay districts – Urban, Suburban, and Rural. Specifically, Objective 7 states – “Preserve Chesapeake’s rural character and provide a regulatory mechanism through which development can occur with minimal environmental and visual impact” (p. 148). Further, the Plan states “economic development of agricultural and rural enterprises should be fostered and promoted including the development of agricultural markets, alternative products, agri-tourism, and eco-tourism” (p. 57).

The Comprehensive Plan also supports the development of clean, renewable energy. Objective 2 of Chapter 3, Goal 1 of the Plan states “the City will encourage the development of alternative energy sources” (p. 127). Further, the Plan states “land use regulations and building codes should incorporate flexibility to allow for new technologies. For example, solar power might require provisions to allow
collector panels, or wind generated power might require provisions to allow for the large windmills that are necessary” (p. 127).

The presence of a solar farm does not preclude adjacent lands from continuing to be farmed, nor does it preclude the land from being farmed following decommissioning of the site. In some circumstances, a solar farm can continue to support traditional agricultural uses, such as grazing of livestock or beekeeping. In addition, a solar farm provides an alternative income source for rural property owners that may help meet capital requirements and keep other farms and rural businesses viable.

When considering the consumption of agricultural land from solar farms, it is helpful to consider the conditions in North Carolina, which has seen a proliferation of solar energy facilities and produces the second most amount of solar power in the United States, behind only California.4 As of December 2016, solar farms occupied approximately 9,000 acres of former agricultural lands in North Carolina, or 0.2% of the state’s 4.75 million acres of total cropland.5 Chesapeake has not lost any agricultural lands due to solar farms to date; however, other forms of development have taken land out of agricultural production, such as residential subdivisions, commercial shopping centers, office parks, and other facilities that support an expanding population. In many ways, solar farms in rural and agricultural areas serve as placeholders against permanent residential and commercial development.

2.8. Taxes and Financial Incentives

The proposed solar farms in Chesapeake to date are on agricultural land enrolled in the City’s Agricultural Land Use program. If the solar farms are constructed, the land will no longer qualify for the program and the change of use will trigger a roll-back tax. An estimate for the Hickory Solar Farm (PLN-USE-2017-003) provided by the City’s Real Estate Assessor projected an amount due of $9,936.33 for the roll-back tax (Attachment 2). In addition, future property tax will be assessed at fair market value of the property, which is expected to increase substantially if a solar farm is constructed, as described in a previous communication provided to City Council (Attachment 3).

The City Attorney’s Office compiled an exhaustive list of federal and state tax incentives for solar energy production (Attachment 4). Notable from a local perspective, the state defines solar panels and the associated infrastructure as certified pollution control devices, which can qualify them for a partial or full exemption from the local machine and tool tax. Solar farm developers are not required to disclose state or federal tax incentives utilized during the local development review process.

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2.9. Construction

Prior to construction, applicants must submit and receive final site construction plan approval, including elements for erosion and sediment control and stormwater management.

The construction period for a solar farm varies depending on the generating capacity. On average, a 20 megawatt (MW) solar farm can require 6-7 months. During construction, between 200-300 employees assist with site preparation, installation of mounting equipment and panels, development of distribution and transmission infrastructure, and screening and landscaping activities. Increased vehicular traffic, noise, and dust are impacts resulting from the construction of solar farms. In addition to being temporary, these impacts can be mitigated through road improvements, limiting construction activities to certain hours of the day, and implementing dust abatement measures, such as water trucks.

2.10. Decommissioning

At the end of the programmed life of the solar farm, typically 25 to 30 years after the facility is completed or when the land lease expires, the site can be decommissioned. This process returns the site to its previous condition and includes de-energization ("unplugging" the solar farm from the grid), panel removal, dismantling of utility equipment and other structures, debris management, removal of undesired access roads, dismantling of security fencing, regrading, and revegetation. Decommissioning agreements can be stipulated at the time of local land use approval. A security bond is typically provided to ensure the decommissioning plan is implemented as adopted.

Below is a typical solar farm decommissioning stipulation suggested by the NC State Clean Energy Technology Center:

“Prior to the expiration or earlier termination of this Lease, Tenant shall restore the Land (and any other land or Landlord impacted by Tenant's use of the Premise) to substantially its condition as of the Effective Date using prudent engineering practices and removing Tenant's Property (including, without limitation, all fencing, roads, solar panels and mounting, and other improvements or alterations) and any electrical or communication or other utility poles, lines and connections (unless such lines and connections are used in connection with other property owned by Landlord and Landlord gives written notice to Tenant at least ninety (90) days prior to the expiration or earlier termination of the Lease identifying the specific lines and connections to remain on the Premises). The removal and restoration shall be completed in a manner that does not materially and adversely affect the use of the Premises for farming purposes.”

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3. Permitting Process

3.1. Federal

The Federal Energy Regulatory Commission (FERC) has jurisdiction over the interconnection of solar farms involving the sale of electricity to a utility. The table in Attachment 5, produced by the National Renewable Energy Laboratory (NREL), summarizes the pertinent Federal laws and regulations for electricity interconnectivity. The standards for interconnection procedures for large scale generators such as the solar farms recently proposed in Chesapeake are primarily contained within FERC Orders 2003 and 661. In addition, through parts II and III of the Federal Power Act, FERC regulates electric transmission and wholesale rates and services. FERC does not issue permits, but all electric generators must adhere to these regulations and obtain FERC authorization.

3.2. State

Effective July 18, 2012, the Virginia DEQ developed the Solar Permit by Rule (PBR) regulation which is codified as Virginia Administrative Code §9VAC15-60. Pursuant to §9VAC15-60-20(B): “The department has determined that a PBR is required for small solar energy projects with a rated capacity greater than five megawatts and a disturbance zone greater than 10 acres.” In the 2017 session of the Virginia General Assembly, SB 1395 was passed, increasing the maximum rated capacity of solar and wind facilities that qualify as small renewable energy projects from 100 MW to 150 MW. The measure also specifies that a small renewable energy project shall be eligible for PBR if it is proposed, developed, constructed, or purchased by a person that is not a regulated utility. DEQ provides guidance documents for applicants to navigate the provisions of its regulation from pre-construction analyses to post-construction monitoring, as well as instructions for performing the required regulatory tasks.

Pursuant to 9VAC15-60-30 Application for PBR for Solar Energy Projects with Rated Capacity Greater Than Five Megawatts and Disturbance Zone Greater Than 10 Acres (Attachment 6), applicants must comply with 15 distinct provisions in order for the state to grant a PBR. Provisions include electricity grid interconnection studies, analysis of potential impacts to natural and historic resources and mitigation measures, approval from the local governing body, and the holding of a public hearing. Upon submission of the necessary documentation for a PBR, state agencies in the Secretariat of Natural Resources determine if the application is complete and meets the requirements of the Code. If so, the applicant is granted a permit and authorized to construct and operate a small solar energy project; however, local approvals and permitting still apply, as discussed below.
3.3. Local

Solar farms are a conditionally allowed use in the C-1, Conservation, C-2, Conservation-Recreation, C-3, Recreation, and A-1, Agriculture zoning districts and a permitted use in all industrial zoning districts. The classification for the use itself per the U.S. Department of Labor Occupational Safety and Health Administration Standard Industrial Classification System (SIC code) is 4911 Electric Services: Establishments engaged in the generation, transmission, and/or distribution of electric energy for sale. To obtain a Conditional Use Permit (CUP), the applicants must comply with and meet the standards set forth in §17-106 Hearing and Action by the Planning Commission of Article 17 in the City of Chesapeake Zoning Ordinance.

Additionally, the project must be in conformity with the objectives set forth in the City’s Comprehensive Plan, and, depending on location, in compliance with the applicable review processes/procedures pursuant to any overlay district it is located in. The City is also required to notify and consult with the U.S. Navy on any development proposal that could affect an installation and/or requires City Council approval. If a CUP is granted, the applicants must submit a final site plan to the Development and Permits Department to obtain a building permit, obtain a valid Run-Off Control Permit from the Department of Public Utilities (if applicable), and must later obtain a Certificate of Use/Occupancy to commence the use of the facility post-construction.

4. Sale of Power

4.1. Process of sale

There are two primary methods for the sale of solar electricity – wholesale and power purchase agreements. The wholesale market allows for the sale of power from solar electricity producers to utilities and other entities that will later distribute to industrial, commercial, and residential customers. Utilities, such as Dominion Energy, may also own solar farms outright and sell power directly to customers on the retail market.

Power purchase agreements (PPA) are contracts between an electric power producer and specific customer whereby the purchaser agrees to buy electricity at a pre-agreed price for a pre-determined period of time. Rates and duration will vary in scope depending on the nature and scale of the project. For developers of utility scale solar energy, revenue could be fixed or could vary, contingent on any stipulations agreed upon between the purchaser and developer. Potential customers could include a utility or end-user, such as a large corporate entity like Amazon or Facebook. PPAs provide assurance to developers and allow for debt service needed to finance the installation and construction of the project.
4.2. Potential buyers

For businesses and corporations who are looking to buy renewable energy, PPAs with third party developers enable the business/corporation to circumvent the risks of retail procurement and increase price certainty by agreeing to longer terms. Traditionally, businesses and corporations were only able to enter into contracts with utilities, but corporate PPAs have recently become more popular as it allows third party power developers to diversify their revenue streams. It is important to note that there are several structures for corporate PPAs, and multiple modalities for achieving mutually beneficial partnerships, e.g. renewable energy certificates, investing in off-site solar power generation facilities, and procuring “green” tariffs, which are defined as a replacement to the standard electricity rate customers are charged for the cost of renewable energy.

5. Comparison to Other Municipalities

5.1. Currituck County

Currituck County has two solar farms, known as the Shawsboro and Wildwood sites (Attachments 7 and 8). At its meeting on February 20, 2017, the Currituck County Board of Commissioners passed an ordinance that bans future development of solar farms pending further study and evaluation by County staff. This ban was in response to an increased number of land use applications seeking approval for the construction of new solar farms and concerns expressed by residents over what they perceive as an unsightly and unsafe land use. Prior to the ban, solar farms in Currituck County required a use permit and underwent review and public hearing at the Planning Board and Board of Commissioners.

5.2. Isle of Wight County

In order to construct a solar farm in Isle of Wight County, applicants must apply and receive a conditional use permit for major utility service from the Isle of Wight Board of Supervisors. At present, the Woodland Solar Farm (Attachment 9), owned by Dominion Energy, is the only solar farm in Isle of Wight County. The project was completed at the end of 2016 and is operational.

5.3. Gloucester County

Gloucester County has a solar ordinance, approved in November 2015, which allows large- or utility-scale solar energy facilities in both industrial and rural countryside zoning districts by-right. A conditional use permit is required in all other zoning districts. There is one solar farm currently under development in Gloucester County, with construction expected to begin by the end of 2017. A recent proposal for a 900-acre solar farm in the rural countryside district has raised the idea of requiring all
solar farms to go through the conditional use permit process.\textsuperscript{7} No action on this concept has been taken to date.

6. Policy Recommendations

In many ways, solar farms are just another form of development and type of land use. Dimensional standards generally apply and other standards, such as vegetative buffering and stormwater management are typically required. Just as with the development of a new office building, shopping center, or residential neighborhood, the City of Chesapeake must make determinations about where solar farms are appropriate, what standards are necessary, and what review process is desired. In this respect, it is recommended that a solar energy policy be implemented to provide consistent guidance in the review and approval of solar energy proposals. Such a policy would incorporate current development review processes and mitigation measures discussed below.

At this time, staff recommends no changes to the existing provisions in the Zoning Ordinance that allow for solar farms in the A-1, Agriculture district as a conditional use. The majority of A-1 zoned land is located in the southern area of the City, away from major population centers and within proximity to existing electrical transmission infrastructure. Staff does not recommend utility-scale solar facilities in more urban or suburban areas, but does encourage small-scale roof or ground-mounted systems in these areas, consistent with the Comprehensive Plan. Additionally, staff does not recommend solar farms in industrial areas as they present their own unique and valuable development opportunities. Further, solar farms should only be located on existing cleared land and directed away from forested sites.

The conditional use review process provides an important opportunity to review each solar farm and determine specific impacts and appropriate mitigation measures. Staff is supportive of this process as it also allows for public input to be heard and considered. In addition to two public hearings with the Planning Commission and City Council associated with the conditional use application process, all solar farms are required to hold a separate public meeting in order to meet the requirements of the state’s PBR.

Mitigation measures designed to address impacts of a solar farm can be included as stipulations of the conditional use permit. Based on previous and current solar farm proposals in Chesapeake, staff recommends the following general stipulations be considered for each conditional use application:

1. PV Panel technology – staff recommends the use of crystalline silicon panels only to ensure there is no threat to human health and safety.
2. Grid connection – staff recommends the applicant/owner describe how the power generated from the site will connect to the existing electrical grid and any new distribution lines need to be placed underground.

\textsuperscript{7} Hubbard, Frances. “Could second solar farm be built in Gloucester County?” Daily Press. 5 June 2017.
3. Site entrance – staff recommends the use of City Standard Commercial Entrance, CG-11A, or better for all entrances to a site.

4. Site buffer – staff recommends a minimum 50’ setback from all property lines. Within the setback, an earthen berm of at least 6’ in height should be constructed where deemed necessary. The berm should be vegetated with an appropriate groundcover and maintained. Small and medium canopy trees and shrubs should be planted between the berm or perimeter fence and property line, as recommended by the City’s Landscape Coordinator.

5. Perimeter fencing – staff recommends a 6’ security fence around the entire perimeter of the site and behind the berm where applicable. Wind screens on the fencing should be avoided.

6. Site vegetation – staff recommends the use of a variety of native groundcovers and other vegetation throughout the site, to include those known as attractive to pollinators. Vegetation should be expeditiously established following completion of construction activities. Management of site vegetation should be performed with minimal use of herbicides.

7. Co-location – staff recommends the sites of solar farms be considered where practicable for use as apiaries and/or allow for the grazing of livestock.

8. Run-Off Control Permit – staff recommends the applicant/owner obtain a valid Run-Off Control Permit from the Department of Public Utilities if located within the Northwest River watershed.

9. Construction – staff recommends all construction activities be limited to 7 a.m. to 7 p.m. If existing residences are not in the vicinity of the site, these hours may be expanded.

10. PPA – staff recommends that each applicant/owner disclose who will purchase the power generated from the site.

11. Military Compatibility – staff recommends that each applicant/owner consult with the U.S. Navy to determine potential impacts to their mission, to include glare/glint and EMF considerations.

12. Decommissioning Plan – staff recommends the development of a decommissioning plan and posting a security bond to ensure implementation. The Plan should specify a timeline for the removal of all equipment and for the return of the site to its pre-use grade.

13. Emergency Management Plan – staff recommends the development of an Emergency Management Plan, which should provide safety guidelines and procedures for potential emergency-related incidents during all phases of the life of the facility (construction, operation, and decommissioning).

14. Insurance – staff recommends the applicant/owner maintain insurance for the duration of use.
7. Summary/Conclusions

The City of Chesapeake has seen an increasing number of applications for utility-scale solar energy facilities. Multiple studies and research indicate that solar farms can safely and successfully be constructed and operated. Based on City Council’s consideration of applications to date and in light of citizen input, it is prudent to develop a solar energy policy. Such policy should build on mitigation measures and stipulations now being recommended by City staff relative to current solar farm applications, such as ensuring compatibility and limiting impact to nearby uses, implementing innovative vegetation management, and guaranteeing the successful operation and retirement of the site.

Please let me know if you have any questions or require further information.

Attachment 1 - Health and Safety Impacts of Solar Photovoltaics by NC State
Attachment 2 – Rollback Tax Statement
Attachment 3 – Property Valuation Letter
Attachment 4 – Memorandum from the Office of the City Attorney
Attachment 5 – Table of Key Federal Interconnection Laws and Regulations
Attachment 6 – 9VAC15-60-30
Attachment 7 – Shawsboro Solar
Attachment 8 – Wildwood Solar
Attachment 9 – Woodland Solar

JMS/jmh

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Attachment 1 – Health and Safety Impacts of Solar Photovoltaics by NC State
Health and Safety Impacts of Solar Photovoltaics

The increasing presence of utility-scale solar photovoltaic (PV) systems (sometimes referred to as solar farms) is a rather new development in North Carolina’s landscape. Due to the new and unknown nature of this technology, it is natural for communities near such developments to be concerned about health and safety impacts. Unfortunately, the quick emergence of utility-scale solar has cultivated fertile grounds for myths and half-truths about the health impacts of this technology, which can lead to unnecessary fear and conflict.

Photovoltaic (PV) technologies and solar inverters are not known to pose any significant health dangers to their neighbors. The most important dangers posed are increased highway traffic during the relative short construction period and dangers posed to trespassers of contact with high voltage equipment. This latter risk is mitigated by signage and the security measures that industry uses to deter trespassing. As will be discussed in more detail below, risks of site contamination are much less than for most other industrial uses because PV technologies employ few toxic chemicals and those used are used in very small quantities. Due to the reduction in the pollution from fossil-fuel-fired electric generators, the overall impact of solar development on human health is overwhelmingly positive. This pollution reduction results from a partial replacement of fossil-fuel fired generation by emission-free PV-generated electricity, which reduces harmful sulfur dioxide (SO₂), nitrogen oxides (NOₓ), and fine particulate matter (PM₂.₅). Analysis from the National Renewable Energy Laboratory and the Lawrence Berkeley National Laboratory, both affiliates of the U.S. Department of Energy, estimates the health-related air quality benefits to the southeast region from solar PV generators to be worth 8.0¢ per kilowatt-hour of solar generation.¹ This is in addition to the value of the electricity and suggests that the air quality benefits of solar are worth more than the electricity itself.

Even though we have only recently seen large-scale installation of PV technologies, the technology and its potential impacts have been studied since the 1950s. A combination of this solar-specific research and general scientific research has led to the scientific community having a good understanding of the science behind potential health and safety impacts of solar energy. This paper utilizes the latest scientific literature and knowledge of solar practices in N.C. to address the health and safety risks associated with solar PV technology. These risks are extremely small, far less than those associated with common activities such as driving a car, and vastly outweighed by health benefits of the generation of clean electricity.

This paper addresses the potential health and safety impacts of solar PV development in North Carolina, organized into the following four categories:

1. Hazardous Materials
2. Electromagnetic Fields (EMF)
3. Electric Shock and Arc Flash
4. Fire Safety
1. Hazardous Materials

One of the more common concerns towards solar is that the panels (referred to as “modules” in the solar industry) consist of toxic materials that endanger public health. However, as shown in this section, solar energy systems may contain small amounts of toxic materials, but these materials do not endanger public health. To understand potential toxic hazards coming from a solar project, one must understand system installation, materials used, the panel end-of-life protocols, and system operation. This section will examine these aspects of a solar farm and the potential for toxicity impacts in the following subsections:

(1.2) Project Installation/Construction
(1.2) System Components
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1.1 Project Installation/Construction

The system installation, or construction, process does not require toxic chemicals or processes. The site is mechanically cleared of large vegetation, fences are constructed, and the land is surveyed to layout exact installation locations. Trenches for underground wiring are dug and support posts are driven into the ground. The solar panels are bolted to steel and aluminum support structures and wired together. Inverter pads are installed, and an inverter and transformer are installed on each pad. Once everything is connected, the system is tested, and only then turned on.

Figure 1: Utility-scale solar facility (5 MWAC) located in Catawba County. Source: Strata Solar
1.2 System Components

1.2.1 Solar Panels: Construction and Durability

Solar PV panels typically consist of glass, polymer, aluminum, copper, and semiconductor materials that can be recovered and recycled at the end of their useful life. Today there are two PV technologies used in PV panels at utility-scale solar facilities, silicon, and thin film. As of 2016, all thin film used in North Carolina solar facilities are cadmium telluride (CdTe) panels from the US manufacturer First Solar, but there are other thin film PV panels available on the market, such as Solar Frontier’s CIGS panels. Crystalline silicon technology consists of silicon wafers which are made into cells and assembled into panels, thin film technologies consist of thin layers of semiconductor material deposited onto glass, polymer or metal substrates. While there are differences in the components and manufacturing processes of these two types of solar technologies, many aspects of their PV panel construction are very similar. Specifics about each type of PV chemistry as it relates to toxicity are covered in subsections a, b, and c in section 1.2.2; on crystalline silicon, cadmium telluride, and CIS/CIGS respectively. The rest of this section applies equally to both silicon and thin film panels.

Figure 2: Components of crystalline silicon panels. The vast majority of silicon panels consist of a glass sheet on the topside with an aluminum frame providing structural support. Image Source: www.riteksolar.com.tw

Figure 3: Layers of a common frameless thin-film panel (CdTe). Many thin film panels are frameless, including the most common thin-film panels, First Solar’s CdTe. Frameless panels have protective glass on both the front and back of the panel. Layer thicknesses not to scale. Image Source: www.homepower.com

To provide decades of corrosion-free operation, PV cells in PV panels are encapsulated from air and moisture between two layers of plastic. The encapsulation layers are protected on the top with a layer of tempered glass and on the backside with a polymer sheet. Frameless modules include a protective layer of glass on the rear of the panel, which may also be tempered. The plastic ethylene-vinyl acetate (EVA) commonly provides the cell encapsulation. For decades, this same material has been used between layers of tempered glass to give car windshields and hurricane windows their great strength. In the same way that a car windshield cracks but stays intact, the EVA layers in PV panels keep broken panels intact (see Figure 4). Thus, a damaged module does not generally create small pieces of debris; instead, it largely remains together as one piece.
PV panels constructed with the same basic components as modern panels have been installed across the globe for well over thirty years. The long-term durability and performance demonstrated over these decades, as well as the results of accelerated lifetime testing, helped lead to an industry-standard 25-year power production warranty for PV panels. These power warranties warrant a PV panel to produce at least 80% of their original nameplate production after 25 years of use. A recent SolarCity and DNV GL study reported that today’s quality PV panels should be expected to reliably and efficiently produce power for thirty-five years.

Local building codes require all structures, including ground mounted solar arrays, to be engineered to withstand anticipated wind speeds, as defined by the local wind speed requirements. Many racking products are available in versions engineered for wind speeds of up to 150 miles per hour, which is significantly higher than the wind speed requirement anywhere in North Carolina. The strength of PV mounting structures were demonstrated during Hurricane Sandy in 2012 and again during Hurricane Matthew in 2016. During Hurricane Sandy, the many large-scale solar facilities in New Jersey and New York at that time suffered only minor damage. In the fall of 2016, the US and Caribbean experienced destructive winds and torrential rains from Hurricane Matthew, yet one leading solar tracker manufacturer reported that their numerous systems in the impacted area received zero damage from wind or flooding.

In the event of a catastrophic event capable of damaging solar equipment, such as a tornado, the system will almost certainly have property insurance that will cover the cost to cleanup and repair the project. It is in the best interest of the system owner to protect their investment against such risks. It is also in their interest to get the project repaired and producing full power as soon as possible. Therefore, the investment in adequate insurance is a wise business practice for the system owner.
reasons, adequate insurance coverage is also generally a requirement of the bank or firm providing financing for the project.

1.2.2 Photovoltaic (PV) Technologies

a. Crystalline Silicon

This subsection explores the toxicity of silicon-based PV panels and concludes that they do not pose a material risk of toxicity to public health and safety. Modern crystalline silicon PV panels, which account for over 90% of solar PV panels installed today, are, more or less, a commodity product. The overwhelming majority of panels installed in North Carolina are crystalline silicon panels that are informally classified as Tier I panels. Tier I panels are from well-respected manufacturers that have a good chance of being able to honor warranty claims. Tier I panels are understood to be of high quality, with predictable performance, durability, and content. Well over 80% (by weight) of the content of a PV panel is the tempered glass front and the aluminum frame, both of which are common building materials. Most of the remaining portion are common plastics, including polyethylene terephthalate in the backsheet, EVA encapsulation of the PV cells, polyphenyl ether in the junction box, and polyethylene insulation on the wire leads. The active, working components of the system are the silicon photovoltaic cells, the small electrical leads connecting them together, and to the wires coming out of the back of the panel. The electricity generating and conducting components makeup less than 5% of the weight of most panels. The PV cell itself is nearly 100% silicon, and silicon is the second most common element in the Earth's crust. The silicon for PV cells is obtained by high-temperature processing of quartz sand (SiO₂) that removes its oxygen molecules. The refined silicon is converted to a PV cell by adding extremely small amounts of boron and phosphorus, both of which are common and of very low toxicity.

The other minor components of the PV cell are also generally benign; however, some contain lead, which is a human toxicant that is particularly harmful to young children. The minor components include an extremely thin antireflective coating (silicon nitride or titanium dioxide), a thin layer of aluminum on the rear, and thin strips of silver alloy that are screen-printed on the front and rear of cell. In order for the front and rear electrodes to make effective electrical contact with the proper layer of the PV cell, other materials (called glass frit) are mixed with the silver alloy and then heated to etch the metals into the cell. This glass frit historically contains a small amount of lead (Pb) in the form of lead oxide. The 60 or 72 PV cells in a PV panel are connected by soldering thin solder-covered copper tabs from the back of one cell to the front of the next cell. Traditionally a tin-based solder containing some lead (Pb) is used, but some manufacturers have switched to lead-free solder. The glass frit and/or the solder may contain trace amounts of other metals, potentially including some with human toxicity such as cadmium. However, testing to simulate the potential for leaching from broken panels, which is discussed in more detail below, did not find a potential toxicity threat from these trace elements. Therefore, the tiny amount of lead in the glass frit and the solder is the only part of silicon PV panels with a potential to create a negative health impact. However, as described below, the very limited amount of lead involved and its strong physical and chemical attachment to other components of the PV panel means that even in worst-case scenarios the health hazard it poses is insignificant.

As with many electronic industries, the solder in silicon PV panels has historically been a lead-based solder, often 36% lead, due to the superior properties of such solder. However, recent advances in lead-free solders have spurred a trend among PV panel manufacturers to reduce or remove the lead in their panels. According to the 2015 Solar Scorecard from the Silicon Valley Toxics Coalition, a group that tracks environmental responsibility of photovoltaic panel manufacturers, fourteen companies (increased from twelve companies in 2014) manufacture PV panels certified to meet the European Restriction of
Hazardous Substances (RoHS) standard. This means that the amount of cadmium and lead in the panels they manufacture fall below the RoHS thresholds, which are set by the European Union and serve as the world’s de facto standard for hazardous substances in manufactured goods. The Restriction of Hazardous Substances (RoHS) standard requires that the maximum concentration found in any homogenous material in a produce is less than 0.01% cadmium and less than 0.10% lead, therefore, any solder can be no more than 0.10% lead.

While some manufacturers are producing PV panels that meet the RoHS standard, there is no requirement that they do so because the RoHS Directive explicitly states that the directive does not apply to photovoltaic panels. The justification for this is provided in item 17 of the current RoHS Directive: “The development of renewable forms of energy is one of the Union’s key objectives, and the contribution made by renewable energy sources to environmental and climate objectives is crucial.Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources (4) recalls that there should be coherence between those objectives and other Union environmental legislation. Consequently, this Directive should not prevent the development of renewable energy technologies that have no negative impact on health and the environment and that are sustainable and economically viable.”

The use of lead is common in our modern economy. However, only about 0.5% of the annual lead consumption in the U.S. is for electronic solder for all uses; PV solder makes up only a tiny portion of this 0.5%. Close to 90% of lead consumption in the US is in batteries, which do not encapsulate the pounds of lead contained in each typical automotive battery. This puts the lead in batteries at great risk of leaching into the environment. Estimates for the lead in a single PV panel with lead-based solder range from 1.6 to 24 grams of lead, with 13g (less than half of an ounce) per panel seen most often in the literature. At 13 g/panel, each panel contains one-half of the lead in a typical 12-gauge shotgun shell. This amount equates to roughly 1/750th of the lead in a single car battery. In a panel, it is all durably encapsulated from air or water for the full life of the panel.

As indicated by their 20 to 30-year power warranty, PV modules are designed for a long service life, generally over 25 years. For a panel to comply with its 25-year power warranty, its internal components, including lead, must be sealed from any moisture. Otherwise, they would corrode and the panel’s output would fall below power warranty levels. Thus, the lead in operating PV modules is not at risk of release to the environment during their service lifetime. In extreme experiments, researchers have shown that lead can leach from crushed or pulverized panels. However, more real-world tests designed to represent typical trash compaction that are used to classify waste as hazardous or non-hazardous show no danger from leaching. For more information about PV panel end-of-life, see the Panel Disposal section.

As illustrated throughout this section, silicon-based PV panels do not pose a material threat to public health and safety. The only aspect of the panels with potential toxicity concerns is the very small amount of lead in some panels. However, any lead in a panel is well sealed from environmental exposure for the operating lifetime of the solar panel and thus not at risk of release into the environment.

### b. Cadmium Telluride (CdTe) PV Panels

This subsection examines the components of a cadmium telluride (CdTe) PV panel. Research demonstrates that they pose negligible toxicity risk to public health and safety while significantly reducing the public’s exposure to cadmium by reducing coal emissions. As of mid-2016, a few hundred MWs of
Cadmium telluride (CdTe) panels, all manufactured by the U.S. company First Solar, have been installed in North Carolina.

Questions about the potential health and environmental impacts from the use of this PV technology are related to the concern that these panels contain cadmium, a toxic heavy metal. However, scientific studies have shown that cadmium telluride differs from cadmium due to its high chemical and thermal stability. Research has shown that the tiny amount of cadmium in these panels does not pose a health or safety risk. Further, there are very compelling reasons to welcome its adoption due to reductions in unhealthy pollution associated with burning coal. Every GWh of electricity generated by burning coal produces about 4 grams of cadmium air emissions. Even though North Carolina produces a significant fraction of our electricity from coal, electricity from solar offsets much more natural gas than coal due to natural gas plants being able to adjust their rate of production more easily and quickly. If solar electricity offsets 90% natural gas and 10% coal, each 5-megawatt (5 MWAC, which is generally 7 MWDC) CdTe solar facility in North Carolina keeps about 157 grams, or about a third of a pound, of cadmium out of our environment.

Cadmium is toxic, but all the approximately 7 grams of cadmium in one CdTe panel is in the form of a chemical compound cadmium telluride, which has 1/100th the toxicity of free cadmium. Cadmium telluride is a very stable compound that is non-volatile and non-soluble in water. Even in the case of a fire, research shows that less than 0.1% of the cadmium is released when a CdTe panel is exposed to fire. The fire melts the glass and encapsulates over 99.9% of the cadmium in the molten glass.

It is important to understand the source of the cadmium used to manufacture CdTe PV panels. The cadmium is a byproduct of zinc and lead refining. The element is collected from emissions and waste streams during the production of these metals and combined with tellurium to create the CdTe used in PV panels. If the cadmium were not collected for use in the PV panels or other products, it would otherwise either be stockpiled for future use, cemented and buried, or disposed of. Nearly all the cadmium in old or broken panels can be recycled which can eventually serve as the primary source of cadmium for new PV panels.

Similar to silicon-based PV panels, CdTe panels are constructed of a tempered glass front, one instead of two clear plastic encapsulation layers, and a rear heat strengthened glass backing (together >98% by weight). The final product is built to withstand exposure to the elements without significant damage for over 25 years. While not representative of damage that may occur in the field or even at a landfill, laboratory evidence has illustrated that when panels are ground into a fine powder, very acidic water is able to leach portions of the cadmium and tellurium, similar to the process used to recycle CdTe panels. Like many silicon-based panels, CdTe panels are reported (as far back ask 1998) to pass the EPA’s Toxic Characteristic Leaching Procedure (TCLP) test, which tests the potential for crushed panels in a landfill to leach hazardous substances into groundwater. Passing this test means that they are classified as non-hazardous waste and can be deposited in landfills. For more information about PV panel end-of-life, see the Panel Disposal section.

There is also concern of environmental impact resulting from potential catastrophic events involving CdTe PV panels. An analysis of worst-case scenarios for environmental impact from CdTe PV panels, including earthquakes, fires, and floods, was conducted by the University of Tokyo in 2013. After reviewing the extensive international body of research on CdTe PV technology, their report concluded, “Even in the worst-case scenarios, it is unlikely that the Cd concentrations in air and sea water will exceed the environmental regulation values.” In a worst-case scenario of damaged panels abandoned on the ground, insignificant amounts of cadmium will leach from the panels. This is because this scenario is
much less conducive (larger module pieces, less acidity) to leaching than the conditions of the EPA’s TCLP test used to simulate landfill conditions, which CdTe panels pass.\textsuperscript{36}

First Solar, a U.S. company, and the only significant supplier of CdTe panels, has a robust panel take-back and recycling program that has been operating commercially since 2005.\textsuperscript{37} The company states that it is “committed to providing a commercially attractive recycling solution for photovoltaic (PV) power plant and module owners to help them meet their module (end of life) EOL obligation simply, cost-effectively and responsibly.” First Solar global recycling services to their customers to collect and recycle panels once they reach the end of productive life whether due to age or damage. These recycling service agreements are structured to be financially attractive to both First Solar and the solar panel owner. For First Solar, the contract provides the company with an affordable source of raw materials needed for new panels and presumably a diminished risk of undesired release of Cd. The contract also benefits the solar panel owner by allowing them to avoid tipping fees at a waste disposal site. The legal contract helps provide peace of mind by ensuring compliance by both parties when considering the continuing trend of rising disposal costs and increasing regulatory requirements.

c. **CIS/CIGS and other PV technologies**

Copper indium gallium selenide PV technology, often referred to as CIGS, is the second most common type of thin-film PV panel but a distant second behind CdTe. CIGS cells are composed of a thin layer of copper, indium, gallium, and selenium on a glass or plastic backing. None of these elements are very toxic, although selenium is a regulated metal under the Federal Resource Conservation and Recovery Act (RCRA).\textsuperscript{38} The cells often also have an extremely thin layer of cadmium sulfide that contains a tiny amount of cadmium, which is toxic. The promise of high efficiency CIGS panels drove heavy investment in this technology in the past. However, researchers have struggled to transfer high efficiency success in the lab to low-cost full-scale panels in the field.\textsuperscript{39} Recently, a CIGS manufacturer based in Japan, Solar Frontier, has achieved some market success with a rigid, glass-faced CIGS module that competes with silicon panels. Solar Frontier produces the majority of CIGS panels on the market today.\textsuperscript{40} Notably, these panels are RoHS compliant,\textsuperscript{41} thus meeting the rigorous toxicity standard adopted by the European Union even thought this directive exempts PV panels. The authors are unaware of any completed or proposed utility-scale system in North Carolina using CIS/CIGS panels.

### 1.2.3 Panel End-of-Life Management

Concerns about the volume, disposal, toxicity, and recycling of PV panels are addressed in this subsection. To put the volume of PV waste into perspective, consider that by 2050, when PV systems installed in 2020 will reach the end of their lives, it is estimated that the global annual PV panel waste tonnage will be 10% of the 2014 global e-waste tonnage.\textsuperscript{42} In the U.S., end-of-life disposal of solar products is governed by the Federal Resource Conservation and Recovery Act (RCRA), as well as state policies in some situations. RCRA separates waste into hazardous (not accepted at ordinary landfill) and solid waste (generally accepted at ordinary landfill) based on a series of rules. According to RCRA, the way to determine if a PV panel is classified as hazardous waste is the Toxic Characteristic Leaching Procedure (TCLP) test. This EPA test is designed to simulate landfill disposal and determine the risk of hazardous substances leaching out of the landfill.\textsuperscript{43,44,45} Multiple sources report that most modern PV panels (both crystalline silicon and cadmium telluride) pass the TCLP test.\textsuperscript{46,47} Some studies found that some older (1990s) crystalline silicon panels, and perhaps some newer crystalline silicon panels (specifics are not given about vintage of panels tested), do not pass the lead (Pb) leachate limits in the TCLP test.\textsuperscript{48,49}
The test begins with the crushing of a panel into centimeter-sized pieces. The pieces are then mixed in an acid bath. After tumbling for eighteen hours, the fluid is tested for forty hazardous substances that all must be below specific threshold levels to pass the test. Research comparing TCLP conditions to conditions of damaged panels in the field found that simulated landfill conditions provide overly conservative estimates of leaching for field-damaged panels. Additionally, research in Japan has found no detectable Cd leaching from cracked CdTe panels when exposed to simulated acid rain.

Although modern panels can generally be landfilled, they can also be recycled. Even though recent waste volume has not been adequate to support significant PV-specific recycling infrastructure, the existing recycling industry in North Carolina reports that it recycles much of the current small volume of broken PV panels. In an informal survey conducted by the NC Clean Energy Technology Center survey in early 2016, seven of the eight large active North Carolina utility-scale solar developers surveyed reported that they send damaged panels back to the manufacturer and/or to a local recycler. Only one developer reported sending damaged panels to the landfill.

The developers reported that they are usually paid a small amount per panel by local recycling firms. In early 2017, a PV developer reported that a local recycler was charging a small fee per panel to recycle damaged PV panels. The local recycling firm known to authors to accept PV panels described their current PV panel recycling practice as of early 2016 as removing the aluminum frame for local recycling and removing the wire leads for local copper recycling. The remainder of the panel is sent to a facility for processing the non-metallic portions of crushed vehicles, referred to as “fluff” in the recycling industry. This processing within existing general recycling plants allows for significant material recovery of major components, including glass which is 80% of the module weight, but at lower yields than PV-specific recycling plants. Notably almost half of the material value in a PV panel is in the few grams of silver contained in almost every PV panel produced today. In the long-term, dedicated PV panel recycling plants can increase treatment capacities and maximize revenues resulting in better output quality and the ability to recover a greater fraction of the useful materials. PV-specific panel recycling technologies have been researched and implemented to some extent for the past decade, and have been shown to be able to recover over 95% of PV material (semiconductor) and over 90% of the glass in a PV panel.

A look at global PV recycling trends hints at the future possibilities of the practice in our country. Europe installed MW-scale volumes of PV years before the U.S. In 2007, a public-private partnership between the European Union and the solar industry set up a voluntary collection and recycling system called PV CYCLE. This arrangement was later made mandatory under the EU’s WEEE directive, a program for waste electrical and electronic equipment. Its member companies (PV panel producers) fully finance the association. This makes it possible for end-users to return the member companies’ defective panels for recycling at any of the over 300 collection points around Europe without added costs. Additionally, PV CYCLE will pick up batches of 40 or more used panels at no cost to the user. This arrangement has been very successful, collecting and recycling over 13,000 tons by the end of 2015.

In 2012, the WEEE Directive added the end-of-life collection and recycling of PV panels to its scope. This directive is based on the principle of extended-producer-responsibility. It has a global impact because producers that want to sell into the EU market are legally responsible for end-of-life management. Starting in 2018, this directive targets that 85% of PV products “put in the market” in Europe are recovered and 80% is prepared for reuse and recycling.

The success of the PV panel collection and recycling practices in Europe provides promise for the future of recycling in the U.S. In mid-2016, the US Solar Energy Industry Association (SEIA) announced that they are starting a national solar panel recycling program with the guidance and support of many
leading PV panel producers. The program will aggregate the services offered by recycling vendors and PV manufacturers, which will make it easier for consumers to select a cost-effective and environmentally responsible end-of-life management solution for their PV products. According to SEIA, they are planning the program in an effort to make the entire industry landfill-free. In addition to the national recycling network program, the program will provide a portal for system owners and consumers with information on how to responsibly recycle their PV systems.

While a cautious approach toward the potential for negative environmental and/or health impacts from retired PV panels is fully warranted, this section has shown that the positive health impacts of reduced emissions from fossil fuel combustion from PV systems more than outweighs any potential risk. Testing shows that silicon and CdTe panels are both safe to dispose of in landfills, and are also safe in worst case conditions of abandonment or damage in a disaster. Additionally, analysis by local engineers has found that the current salvage value of the equipment in a utility scale PV facility generally exceeds general contractor estimates for the cost to remove the entire PV system.

1.2.4 Non-Panel System Components (racking, wiring, inverter, transformer)

While previous toxicity subsections discussed PV panels, this subsection describes the non-panel components of utility-scale PV systems and investigates any potential public health and safety concerns. The most significant non-panel component of a ground-mounted PV system is the mounting structure of the rows of panels, commonly referred to as “racking”. The vertical post portion of the racking is galvanized steel and the remaining above-ground racking components are either galvanized steel or aluminum, which are both extremely common and benign building materials. The inverters that make the solar generated electricity ready to send to the grid have weather-proof steel enclosures that protect the working components from the elements. The only fluids that they might contain are associated with their cooling systems, which are not unlike the cooling system in a computer. Many inverters today are RoHS compliant.

The electrical transformers (to boost the inverter output voltage to the voltage of the utility connection point) do contain a liquid cooling oil. However, the fluid used for that function is either a non-toxic mineral oil or a biodegradable non-toxic vegetable oil, such as BIOTEMP from ABB. These vegetable transformer oils have the additional advantage of being much less flammable than traditional mineral oils. Significant health hazards are associated with old transformers containing cooling oil with toxic PCBs. Transfers with PCB-containing oil were common before PCBs were outlawed in the U.S. in 1979. PCBs still exist in older transformers in the field across the country.

Other than a few utility research sites, there are no batteries on- or off-site associated with utility-scale solar energy facilities in North Carolina, avoiding any potential health or safety concerns related to battery technologies. However, as battery technologies continue to improve and prices continue to decline we are likely to start seeing some batteries at solar facilities. Lithium ion batteries currently dominate the world utility-scale battery market, which are not very toxic. No non-panel system components were found to pose any health or environmental dangers.

1.4 Operations and Maintenance – Panel Washing and Vegetation Control
Throughout the eastern U.S., the climate provides frequent and heavy enough rain to keep panels adequately clean. This dependable weather pattern eliminates the need to wash the panels on a regular basis. Some system owners may choose to wash panels as often as once a year to increase production, but most in N.C. do not regularly wash any PV panels. Dirt build up over time may justify panel washing a few times over the panels’ lifetime; however, nothing more than soap and water are required for this activity.

The maintenance of ground-mounted PV facilities requires that vegetation be kept low, both for aesthetics and to avoid shading of the PV panels. Several approaches are used to maintain vegetation at NC solar facilities, including planting of limited-height species, mowing, weed-eating, herbicides, and grazing livestock (sheep). The following descriptions of vegetation maintenance practices are based on interviews with several solar developers as well as with three maintenance firms that together are contracted to maintain well over 100 of the solar facilities in N.C. The majority of solar facilities in North Carolina maintain vegetation primarily by mowing. Each row of panels has a single row of supports, allowing sickle mowers to mow under the panels. The sites usually require mowing about once a month during the growing season. Some sites employ sheep to graze the site, which greatly reduces the human effort required to maintain the vegetation and produces high quality lamb meat.

In addition to mowing and weed eating, solar facilities often use some herbicides. Solar facilities generally do not spray herbicides over the entire acreage; rather they apply them only in strategic locations such as at the base of the perimeter fence, around exterior vegetative buffer, on interior dirt roads, and near the panel support posts. Also unlike many row crop operations, solar facilities generally use only general use herbicides, which are available over the counter, as opposed to restricted use herbicides commonly used in commercial agriculture that require a special restricted use license. The herbicides used at solar facilities are primarily 2-4-D and glyphosate (Round-up®), which are two of the most common herbicides used in lawns, parks, and agriculture across the country. One maintenance firm that was interviewed sprays the grass with a class of herbicide known as a growth regulator in order to slow the growth of grass so that mowing is only required twice a year. Growth regulators are commonly used on highway roadsides and golf courses for the same purpose. A commercial pesticide applicator license is required for anyone other than the landowner to apply herbicides, which helps ensure that all applicators are adequately educated about proper herbicide use and application. The license must be renewed annually and requires passing of a certification exam appropriate to the area in which the applicator wishes to work. Based on the limited data available, it appears that solar facilities in N.C. generally use significantly less herbicides per acre than most commercial agriculture or lawn maintenance services.

2. Electromagnetic Fields (EMF)

PV systems do not emit any material during their operation; however, they do generate electromagnetic fields (EMF), sometimes referred to as radiation. EMF produced by electricity is non-ionizing radiation, meaning the radiation has enough energy to move atoms in a molecule around (experienced as heat), but not enough energy to remove electrons from an atom or molecule (ionize) or to damage DNA. As shown below, modern humans are all exposed to EMF throughout our daily lives without negative health impact. Someone outside of the fenced perimeter of a solar facility is not exposed to significant EMF from the solar facility. Therefore, there is no negative health impact from the EMF.
produced in a solar farm. The following paragraphs provide some additional background and detail to support this conclusion.

Since the 1970s, some have expressed concern over potential health consequences of EMF from electricity, but no studies have ever shown this EMF to cause health problems. These concerns are based on some epidemiological studies that found a slight increase in childhood leukemia associated with average exposure to residential power-frequency magnetic fields above 0.3 to 0.4 µT (microteslas) (equal to 3.0 to 4.0 mG (milligauss)). µT and mG are both units used to measure magnetic field strength. For comparison, the average exposure for people in the U.S. is one mG or 0.1 µT, with about 1% of the population with an average exposure in excess of 0.4 µT (or 4 mG). These epidemiological studies, which found an association but not a causal relationship, led the World Health Organization’s International Agency for Research on Cancer (IARC) to classify ELF magnetic fields as “possibly carcinogenic to humans”. Coffee also has this classification. This classification means there is limited evidence but not enough evidence to designate as either a “probable carcinogen” or “human carcinogen”. Overall, there is very little concern that ELF EMF damages public health. The only concern that does exist is for long-term exposure above 0.4 µT (4 mG) that may have some connection to increased cases of childhood leukemia. In 1997, the National Academies of Science were directed by Congress to examine this concern and concluded:

“Based on a comprehensive evaluation of published studies relating to the effects of power-frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects.”

There are two aspects to electromagnetic fields, an electric field and a magnetic field. The electric field is generated by voltage and the magnetic field is generated by electric current, i.e., moving electrons. A task group of scientific experts convened by the World Health Organization (WHO) in 2005 concluded that there were no substantive health issues related to electric fields (0 to 100,000 Hz) at levels generally encountered by members of the public. The relatively low voltages in a solar facility and the fact that electric fields are easily shielded (i.e., blocked) by common materials, such as plastic, metal, or soil means that there is no concern of negative health impacts from the electric fields generated by a solar facility. Thus, the remainder of this section addresses magnetic fields. Magnetic fields are not shielded by most common materials and thus can easily pass through them. Both types of fields are strongest close to the source of electric generation and weaken quickly with distance from the source.

The direct current (DC) electricity produced by PV panels produce stationary (0 Hz) electric and magnetic fields. Because of minimal concern about potential risks of stationary fields, little scientific research has examined stationary fields’ impact on human health. In even the largest PV facilities, the DC voltages and currents are not very high. One can illustrate the weakness of the EMF generated by a PV panel by placing a compass on an operating solar panel and observing that the needle still points north.

While the electricity throughout the majority of a solar site is DC electricity, the inverters convert this DC electricity to alternating current (AC) electricity matching the 60 Hz frequency of the grid. Therefore, the inverters and the wires delivering this power to the grid are producing non-stationary EMF, known as extremely low frequency (ELF) EMF, normally oscillating with a frequency of 60 Hz. This frequency is at the low-energy end of the electromagnetic spectrum. Therefore, it has less energy than
other commonly encountered types of non-ionizing radiation like radio waves, infrared radiation, and visible light.

The wide use of electricity results in background levels of ELF EMFs in nearly all locations where people spend time – homes, workplaces, schools, cars, the supermarket, etc. A person’s average exposure depends upon the sources they encounter, how close they are to them, and the amount of time they spend there. As stated above, the average exposure to magnetic fields in the U.S. is estimated to be around one mG or 0.1 µT, but can vary considerably depending on a person’s exposure to EMF from electrical devices and wiring. At times we are often exposed to much higher ELF magnetic fields, for example when standing three feet from a refrigerator the ELF magnetic field is 6 mG and when standing three feet from a microwave oven the field is about 50 mG. The strength of these fields diminish quickly with distance from the source, but when surrounded by electricity in our homes and other buildings moving away from one source moves you closer to another. However, unless you are inside of the fence at a utility-scale solar facility or electrical substation it is impossible to get very close to the EMF sources. Because of this, EMF levels at the fence of electrical substations containing high voltages and currents are considered “generally negligible”.

The strength of ELF-EMF present at the perimeter of a solar facility or near a PV system in a commercial or residential building is significantly lower than the typical American’s average EMF exposure. Researchers in Massachusetts measured magnetic fields at PV projects and found the magnetic fields dropped to very low levels of 0.5 mG or less, and in many cases to less than background levels (0.2 mG), at distances of no more than nine feet from the residential inverters and 150 feet from the utility-scale inverters. Even when measured within a few feet of the utility-scale inverter, the ELF magnetic fields were well below the International Commission on Non-Ionizing Radiation Protection’s recommended magnetic field level exposure limit for the general public of 2,000 mG. It is typical that utility scale designs locate large inverters central to the PV panels that feed them because this minimizes the length of wire required and shields neighbors from the sound of the inverter’s cooling fans. Thus, it is rare for a large PV inverter to be within 150 feet of the project’s security fence.

Anyone relying on a medical device such as pacemaker or other implanted device to maintain proper heart rhythm may have concern about the potential for a solar project to interfere with the operation of his or her device. However, there is no reason for concern because the EMF outside of the solar facility’s fence is less than 1/1000 of the level at which manufacturers test for ELF EMF interference, which is 1,000 mG. Manufacturers of potentially affected implanted devices often provide advice on electromagnetic interference that includes avoiding letting the implanted device get too close to certain sources of fields such as some household appliances, some walkie-talkies, and similar transmitting devices. Some manufacturers’ literature does not mention high-voltage power lines, some say that exposure in public areas should not give interference, and some advise not spending extended periods of time close to power lines.

3. Electric Shock and Arc Flash Hazards

There is a real danger of electric shock to anyone entering any of the electrical cabinets such as combiner boxes, disconnect switches, inverters, or transformers; or otherwise coming in contact with voltages over 50 Volts. Another electrical hazard is an arc flash, which is an explosion of energy that can occur in a short circuit situation. This explosive release of energy causes a flash of heat and a shockwave, both of which can cause serious injury or death. Properly trained and equipped technicians and electricians know how to safely install, test, and repair PV systems, but there is always some risk of
injury when hazardous voltages and/or currents are present. Untrained individuals should not attempt to inspect, test, or repair any aspect of a PV system due to the potential for injury or death due to electric shock and arc flash. The National Electric Code (NEC) requires appropriate levels of warning signs on all electrical components based on the level of danger determined by the voltages and current potentials. The national electric code also requires the site to be secured from unauthorized visitors with either a six-foot chain link fence with three strands of barbed wire or an eight-foot fence, both with adequate hazard warning signs.

4. Fire Safety

The possibility of fires resulting from or intensified by PV systems may trigger concern among the general public as well as among firefighters. However, concern over solar fire hazards should be limited because only a small portion of materials in the panels are flammable, and those components cannot self-support a significant fire. Flammable components of PV panels include the thin layers of polymer encapsulates surrounding the PV cells, polymer backsheets (framed panels only), plastic junction boxes on rear of panel, and insulation on wiring. The rest of the panel is composed of non-flammable components, notably including one or two layers of protective glass that make up over three quarters of the panel’s weight.

Heat from a small flame is not adequate to ignite a PV panel, but heat from a more intense fire or energy from an electrical fault can ignite a PV panel. One real-world example of this occurred during July 2015 in an arid area of California. Three acres of grass under a thin film PV facility burned without igniting the panels mounted on fixed-tilt racks just above the grass. While it is possible for electrical faults in PV systems on homes or commercial buildings to start a fire, this is extremely rare. Improving understanding of the PV-specific risks, safer system designs, and updated fire-related codes and standards will continue to reduce the risk of fire caused by PV systems.

PV systems on buildings can affect firefighters in two primary ways, 1) impact their methods of fighting the fire, and 2) pose safety hazard to the firefighters. One of the most important techniques that firefighters use to suppress fire is ventilation of a building’s roof. This technique allows superheated toxic gases to quickly exit the building. By doing so, the firefighters gain easier and safer access to the building. Ventilation of the roof also makes the challenge of putting out the fire easier. However, the placement of rooftop PV panels may interfere with ventilating the roof by limiting access to desired venting locations.

New solar-specific building code requirements are working to minimize these concerns. Also, the latest National Electric Code has added requirements that make it easier for first responders to safely and effectively turn off a PV system. Concern for firefighting a building with PV can be reduced with proper fire fighter training, system design, and installation. Numerous organizations have studied fire fighter safety related to PV. Many organizations have published valuable guides and training programs. Some notable examples are listed below.

- The International Association of Fire Fighters (IAFF) and International Renewable Energy Council (IREC) partnered to create an online training course that is far beyond the PowerPoint click-and-view model. The self-paced online course, “Solar PV Safety for Fire Fighters,” features rich video content and simulated environments so fire fighters can practice the knowledge they’ve learned. www.iaff.org/pvsafetytraining
- Photovoltaic Systems and the Fire Code: Office of NC Fire Marshal
- Fire Service Training, Underwriter’s Laboratory
• Firefighter Safety and Response for Solar Power Systems, National Fire Protection Research Foundation
• Bridging the Gap: Fire Safety & Green Buildings, National Association of State Fire Marshalls
• Guidelines for Fire Safety Elements of Solar Photovoltaic Systems, Orange County Fire Chiefs Association
• Solar Photovoltaic Installation Guidelines, California Department of Forestry & Fire Protection, Office of the State Fire Marshall
• PV Safety & Firefighting, Matthew Paiss, Homepower Magazine
• PV Safety and Code Development: Matthew Paiss, Cooperative Research Network

Summary

The purpose of this paper is to address and alleviate concerns of public health and safety for utility-scale solar PV projects. Concerns of public health and safety were divided and discussed in the four following sections: (1) Toxicity, (2) Electromagnetic Fields, (3) Electric Shock and Arc Flash, and (4) Fire. In each of these sections, the negative health and safety impacts of utility-scale PV development were shown to be negligible, while the public health and safety benefits of installing these facilities are significant and far outweigh any negative impacts.


Okkenhaug G. *Leaching from CdTe PV module material results from batch, column and availability tests.* Norwegian Geotechnical Institute, NGI report No. 20092155-00-6-R; 2010


17 ibid


22 Data not available on fraction of various generation sources offset by solar generation in NC, but this is believed to be a reasonable rough estimate. The SunShot report entitled The Environmental and Public Health Benefits of Achieving High Penetrations of Solar Energy in the United States analysis contributes significant (not provided) offsetting of coal-fired generation by solar PV energy in the southeast.

23 7 MWDC * 1.5 GWh/MWDC * 25 years * 0.93 degradation factor * (0.1 *4.65 grams/GWh + 0.9*0.2 grams/GWh)


30 Cunningham D., Discussion about TCLP protocols, Photovoltaics and the Environment Workshop, July 23-24, 1998, Brookhaven National Laboratory, BNL-52557

31 Cunningham D., Discussion about TCLP protocols, Photovoltaics and the Environment Workshop, July 23-24, 1998, Brookhaven National Laboratory, BNL-52557


75 Ibid.

76 Ibid.


78 Ibid.


Published by the N.C. Clean Energy Technology Center at N.C. State University
Attachment 2 – Rollback Tax Statement
## Real Estate Assessor

### DRAFT

### Total Amount Due & Payable:

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**Legal Description:** NE HICKORY 1/5 AC

**Application No.:** 0411

**Mailing Address:** 699 WATERSIDE DR STE 1400 NORFOLK VA 23510-3300

**Owner Name:** NEWBERRY FARMS L L C

**Map & Parcel No.:** 09/2000000000609

**Date:** MAY 23, 2017

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**On Real Estate Which Has Been Taxed In accordance With the Land Use Assessment Law**
Attachment 3 – Property Valuation Letter
May 24, 2017

North Ridge Resources LLC  
Attn: Ken Niemann  
2701 Farm Road  
Alexandria, VA 22302  

Re: Proposed Solar Farm Site on Ballentine Road, 0970000000660  

Dear Mr. Niemann:  

There are three approaches for valuing real estate, the Cost Approach, Income Approach and Sales Comparison Approach. Land valuation is based on the Sales Comparison or Income Approach to value.  

Your proposed project contains approximately 145 acres located on Ballentine Road. Since you have a land lease, I would convert the annual Net Operating Income (NOI) into a valuation by applying a capitalization rate.  

I would generally use a capitalization rate between 8% - 10% with ground leases. Therefore if the annual NOI is $700 per acre, a cap rate of 9% would indicate a value of $7,800 per acre. If the NOI was $1,000 per acre, a cap rate of 9% would indicate a value of $11,100 per acre.  

I hope this illustrates the methodology that may be utilized to calculate the assessed value. Please let me know if you have any more questions.  

Sincerely,  

[Signature]  
Gregory H. Daniels, CAE  
Real Estate Assessor
Attachment 4 – Memorandum from the Office of the City Attorney
July 5, 2017

TO: Mayor Krasnoff, Vice-Mayor de Triquet and Members of the City Council

Re: Federal and state tax incentives and grants for solar energy production

On June 20, 2017, Council Member Ike requested a survey of all federal and state incentives relating to the installation and operation of solar facilities. The attached memorandum from Assistant City Attorney, Ms. Jamie Berardi, sets forth an extensive summary of her research in this regard.

Please advise if you have any questions or would like additional information regarding any of the programs discussed in the memorandum.

Very truly yours,

Jan L. Proctor
City Attorney

JLP:hvm
Attachment
cc: James E. Baker, City Manager
    Jaleh M. Shea, Director, Planning Department

"The City of Chesapeake adheres to the principles of equal employment opportunity. This policy extends to all programs and services supported by the City."
MEMORANDUM

June 28, 2017

To: Jan Proctor, City Attorney

From: Jamie Berardi, Assistant City Attorney

Re: Federal and state tax incentives and grants for solar energy production

Issue

Research state and federal tax incentives and grants for solar energy production.

Discussion

Federal and state governments have focused efforts towards a robust renewable energy program in order to address environmental and economic concerns at governmental, commercial, and consumer levels. As a consequence, the solar industry has experienced a boon as of late. Tax incentives and grants offered at the national and state levels have contributed to economic growth in the solar sector as well as other renewable energy programs. The following is a summary of federal and state tax incentives, grants and loan programs.

A. FEDERAL TAX INCENTIVES AND GRANTS FOR SOLAR ENERGY DEVELOPMENT


Under 26 U.S.C. § 48(a)(3) the federal government extends a corporate tax credit to businesses that invest in renewable power. Available for solar water heat systems, solar space heat, solar thermal electric, solar thermal process heat, and photovoltaics, the credit is designed as a dollar-for-dollar reduction in the income taxes a company would otherwise pay the federal government. The ITC is currently a thirty percent federal tax credit claimed against the tax liability of commercial and utility investments in solar power. There is no dollar cap currently associated with the tax credit. However, other non-taxable incentives such as non-taxable rebates from utilities or a non-taxable grant must be deducted before the ITC reduction is calculated.
Although the current credit is established at thirty percent through 2019, the percentage of the credit will reduce to twenty-six percent in 2020 and twenty-two percent in 2021. Thereafter, the commercial and utility credit will further reduce to a permanent ten percent. Of note, the business which installs, develops, and/or finances the project is the eligible entity that can claim the credit.

2. **Investment Tax Credit ("ITC") 26 U.S.C. § 25D Residential renewable energy tax credit.**

Under the residential section of the ITC, a taxpayer may claim a credit of thirty percent through 2019 towards personal income taxes of qualified expenditures for a system that serves a dwelling unit located in the United States and is owned and used as a residence by the taxpayer. ITC then steps down the percentage of the credit to twenty-six percent in 2020 and twenty-two percent in 2021. After 2021, the residential credit will drop to zero. ITC for residential applicability is also a dollar-for-dollar reduction, without a dollar cap in the income taxes that a person claiming the credit would otherwise pay the federal government.

Eligible solar energy property includes equipment that uses solar energy to generate electricity, to heat or cool, provide hot water for use in a structure, or to provide solar process heat. Hybrid solar lighting systems, which use solar energy to illuminate the inside of a structure using fiber-optic distributed sunlight, are also eligible; however, passive solar systems and solar pool-heating systems are not. ITC residential credit is used when homeowners purchase solar systems outright, and the equipment is installed on their homes. If the federal tax credit exceeds tax liability, the excess amount may be carried forward to the following taxable year.


Projected economic and technological impacts of the commercial and residential ITCs are many. By incentivizing the utilization of renewable energy as a viable means for business development and as a means to offset residential costs, solar prices are projected to continue to fall until they achieve parity with current costs associated with conventional, non-renewable energy. The reduction in costs should contribute to an increase in both installation rates and technological efficiencies.

Moreover, the economic job growth projections are based on 2016 job statistics in which approximately 260,000 Americans were employed in the solar sector. That employment number is expected to double to 420,000 within five years. Solar Energy Industries Association, http://www.seia.org/policy/finance-tax/solar-investment-tax-credit (last visited June 27, 2017). Economists estimate the projected growth to spur approximately $140 billion in economic activity, and with the existence of the ITC through 2021, companies can rely on market certainty for companies thereby allowing them to develop long-term investment strategies. Id. Those investment strategies should drive market competition and innovation which may reduce future costs to consumers. Id.
4. **Modified Accelerated Cost-Recovery System (MACRS).**

The Modified Accelerated Cost-Recovery System is the current tax depreciation system promulgated by the Internal Revenue Service. As it relates to solar energy, MACRS accelerates the tax liability for commercial entities that pursue renewable energy as a means to conduct business. Accelerated depreciation means shortening the useful life of a piece of capital as it's recorded for tax purposes. MACRS can be used in conjunction with ITC, but, notably, the thirty percent tax credit is applied to the depreciated value under MACRS and not the full value of the property outside the applied depreciation of MACRS. https://www.getsolar.com/commercial/federal-incentives-for-commercial-solar.

For solar equipment installed after 1986, the IRS determined the property class to be five years. I.R.S. Publication 946, (2012) https://www.irs.gov/publications/p946/ch04.html. The five year classification permits business entities to apply that timeframe to determine the asset depreciation. In addition, the federal stimulus legislation of October 2008 and February 2009 includes a one-time, fifty percent bonus depreciation for systems purchased and installed in 2008 and 2009. EnergySage Solar, https://www.getsolar.com/commercial/federal-incentives-for-commercial-solar. This fifty percent bonus depreciation has been extended through January 1, 2018. *Id.* Thereafter, the depreciation drops to forty percent for the rest of 2018 and thirty percent for 2019. *Id.*

Recent estimates suggest solar companies will receive cash flows from a solar-energy system for up to twenty-five years. *Id.* The total value of that system, in terms of upfront costs, will be taken out of gross income over the five-year period allowed by MACRS. *Id.* While MACRS will reduce income on the company's financial statement, the result leads to an improved tax situation. *Id.* The government allows the company to take full account of accelerated depreciation when determining profits which, ultimately, reduces the company's tax liability. *Id.*

5. **Assistance to high energy cost communities CFR § 1709.**

The U.S. Department of Agriculture offers an ongoing grant program for the improvement of energy generation, transmission, and distribution facilities in rural communities that have energy costs at least 275% above the national average. Commercial, industrial, local government, nonprofit, residential, schools, state government, tribal government, and institutional sectors are eligible recipients of the grant funding. The last solicitation was in 2015 and comprised a budget of $10 million in available funding. Typical grants ranged from $50,000 to $3 million. Eligible solar technologies include water heat, space heat, thermal electric, thermal process heat, photovoltaics. The program is not limited to renewable energy or energy conservation and efficiency measures, but they are eligible for funding. 7 CFR 1709.109.

U.S. Department of Energy loan program is for projects with high technology risks that "avoid, reduce or sequester air pollutants or anthropogenic emissions of greenhouse gases; and employ new or significantly improved technologies as compared to commercial technologies in service in the United States at the time the guarantee is issued." Energy Policy Act of 2005, 42 U.S.C. § 1703 (2005). Loan guarantees are intended to encourage early commercial use of new or significantly improved technologies in energy projects.

Eligible solar technologies that may apply for loan guarantees include thermal electric, thermal process heat, and photovoltaics. Commercial, industrial, local government, nonprofit, schools, state government, agricultural, and institutional sectors are eligible to apply for loans. Up to $4.5 billion is available in loan guarantees for projects that include but are not limited to renewable energy. Full repayment is required over a period not to exceed the lesser of 30 years or 90% of the projected useful life of the asset to be financed.


The Energy Improvement and Extension Act of 2008 authorized Qualified Energy Conservation Bonds (QECBs) and Clean Energy Conservation Bonds (CREBs) to finance certain types of energy projects, including solar thermal and solar photovoltaics. QECBs may be issued by state, local and tribal governments, whereas CREBs may be issued by public power utilities, electric cooperatives, government entities, and certain lenders. Both QECBs and CREBs were changed from tax credit bonds to direct subsidy bonds in 2010.

The U.S. Treasury allocates QECBs/CREBs to a qualified issuer who then sells the bonds to investors. The proceeds of the bond sales are used to fund the energy project. The issuer of the bond is required to pay the investor a taxable coupon semi-annually and repays the principal on the bond at the end of the seventeen year maturity cycle. In exchange, the issuer receives a rebate from the U.S. Treasury for the lesser of either the taxable rate of the bonds or 70 percent of the published tax credit rate (currently 5.34%).

The allowable bond volume that can be distributed is set at $3.2 billion for QECBs. QECBs are not subject to a U.S. Department of Treasury application and approval process; rather, the number of bonds are allocated to each state and are based on population numbers from 2008. Each state is then required to allocate a portion of its bonds to "large local governments" within the state based on the local government's percentage of the state's population. Large local governments are defined as municipalities and counties with populations of 100,000 or more. Local governments that do not issue their QECBs reallocate the bonds back to the state. Further, 70 percent of QECBs issued to states must be used to finance governmental projects. The remaining 30 percent may be used for private projects.

Conversely, CREBs do require an application process in which participants first apply to the Internal Revenue Service for a CREBs allocation, and the CREB program is limited by the
volume of bonds allocated by Congress. Currently, the allowable bond volume that can be
distributed is set at $2.4 billion for CREBs.


Energy conservation subsidies provided, directly or indirectly, to customers by public
utilities are non-taxable. If a taxpayer claims federal tax credits or deductions for the energy
conservation property, the investment basis for the purpose of claiming the deduction or tax
credit must be reduced by the value of the energy conservation subsidy.

The definition of "energy conservation measure" includes installations or modifications
primarily designed to reduce consumption of electricity or natural gas, or to improve the
management of energy demand. The definition does not explicitly include residential solar-
thermal projects and photovoltaics. Since the IRS has not ruled definitively on whether solar
technologies are non-taxable, evaluation by a tax professional to ensure eligibility would be
prudent.


USDA REAP grants provide guaranteed loan financing and grant funding to agricultural
producers and rural small businesses for renewable energy systems or to make energy efficiency
improvements. Agricultural producers, in rural or non-rural areas, must have at least fifty percent
of gross income coming from agricultural operations. Small businesses are eligible if they are
located in a prescribed eligibility area. Of note, the agricultural producer or small business must
not have outstanding delinquent federal taxes, debt, judgment or debarment in order to qualify.

Funds may be used for a myriad of renewable energy systems to include small and large
solar generation as well as for the purchase, installation and construction of energy efficient
improvements. Grants up to $20,000 are awarded twice a year and awards up to $500,000 are
awarded once annually. Grants can cover up to twenty-five percent of total eligible project costs.
Loan guarantees are completed throughout the year on a continual basis for a minimum amount
of $5,000 and a maximum of $25 million. Moreover, loan guarantees can cover up to seventy-
five percent of total eligible project costs. If an applicant sought both a grant and loan guarantee,
the combined funding may be up to seventy-five percent of total eligible project costs.

10. 7 U.S.C. § 8107 Rural Energy for America Program (REAP) Energy Audit and
Renewable Energy Development Assistance (EA/REDA) Program.

The Renewable Energy for America Program (REAP) Energy Audit and Renewable
Energy Development Assistance Program (EA/REDA) are grants that allow recipients to provide
assistance to agricultural producers and rural small businesses through energy audits, site
assessments, and renewable energy technical assistance.

Eligibility is open to state and local governments, federally recognized tribes, land-grant
colleges or universities, rural electric cooperatives, public power entities, and instrumentalities of
a state, tribal, or local government. Applicants must submit separate applications, limited to one
energy audit and one REDA per fiscal year. The maximum aggregate amount of an energy audit and REDA grant in a federal fiscal year is $100,000. Funding may be used for salaries related to the project, travel expenses related to the assistance, office supplies, and administrative expenses up to five percent of the grant award.

B. STATE TAX INCENTIVES AND GRANTS FOR SOLAR ENERGY DEVELOPMENT


Enacted in 2007, RPS is a non-binding program which incentivizes renewable energy development. The statute specifies any incumbent investor-owned electric utility can apply to the State Corporation Commission to participate in the RPS program, and the Commission “shall approve such application if the applicant demonstrates that it has a reasonable expectation of achieving 12 percent of its base year electric energy sales from renewable energy sources during calendar year 2022, and 15 percent of its base year electric energy sales from renewable energy sources during calendar year 2025.” VA. CODE ANN. § 56-585.2 (2007).

To participate, the utility must demonstrate it reasonably expects to achieve increasing percentages of its electricity sales from eligible renewable energy sources. Participating utilities are given a series of four escalating goals to meet based on percentages of base year energy sales. To date, Goals 1 and 2 have passed. Goal 3 requires a utility average seven percent of base year sales for calendar years 2017-2021 and reaching twelve percent of base year sales by calendar year 2022; and Goal 4, requires averaging twelve percent of base year sales for calendar years 2023-2024 and reaching fifteen percent of base year sales by calendar year 2025. In addition, the participating utility must provide an annual report by November 1 to the State Corporation Commission which details the utility’s efforts to reach the specified goals and any technological advances. There are no monetary penalties for non-conformance to the RPS goals; however, the Commission posts on its website the reports of each participating utility.

The incentives for satisfactory participation in RPS are three-fold. A utility participating in the program and in conformance of its goals can recover all incremental costs related to its participation in the RPS program through rate adjustment clauses. The incremental costs incurred through participation in the program include, but are not limited to, administrative costs, ancillary costs, capacity costs, and costs of energy. Additionally, funds used for construction of renewable energy generation facilities are recoverable. Participants can also earn a fifty basis point (0.5%) increase on their rate of return on common equity. Curtis, supra, at 776. Lastly, as an added bonus with respect to solar and wind energy “a utility shall receive double credit toward meeting the renewable energy portfolio standard for energy derived from sunlight . . . .” Id.

Criticism of Virginia’s non-binding RPS identify the double credit for solar energy RPS goals as problematic due, in large part, to the fact the RPS goal is geared towards large-scale utility-owned renewable power facilities. Curtis, supra, at 789. For the foreseeable future, Virginia is incapable for solar operations of that size, and, thus, the market demand and not the credit should dictate which sources of energy are developed in the Commonwealth. Id. Another
criticism of Virginia’s RPS considers the credit relating to the rate of return on common equity by fifty basis points (0.5%) when it meets the RPS Goal. Id. at 790. When a return on common equity increases, the cost is transferred to the customer. Id. As a result, the consumer is not only responsible for covering the incremental costs determined by rate adjustment clauses incurred by the utility’s participation in RPS, but also the consumer must cover the cost associated with the increase on the return on common equity. Id.

2. Photovoltaic, solar, and wind energy utilization grant program. §§ 67-1000 to 1003.

a. Eligibility for grants for installation of photovoltaic property, solar water heating property, and wind-powered electrical generators § 67-1001.

The allowable grant is 15% of the total installed cost of photovoltaic property, solar water heating property, or wind-powered electrical generators, but it cannot exceed the aggregate of

   i)  $2000 for each system of photovoltaic property;

   ii) $1000 for each system of solar water heating property; and

   iii) $1000 for each system of wind-powered electrical generators.

b. Solar and Wind Energy System Acquisition Grant Fund § 67-1002.

This establishes the non-reverting fund to which the General Assembly can appropriate funds from time to time.

c. Requirements for grants, generally § 67-1003.

Individuals and corporations may submit a grant application before equipment installation or by March 31 of the year following the calendar year in which the property was installed. Within fourteen days of receipt of the application, the Department of Mines, Minerals and Energy must notify the applicant as to whether there is sufficient money to fund the grant. The applicant must also provide evidence of the cost of the installed equipment and have available, upon request, any documents needed to determine whether the requirements for grant funding eligibility have been satisfied. Lastly, an applicant who receives grant funding may not use the eligible equipment for any other grant or tax credit.
3. **Voluntary Solar Resource Fund Development §§ 67-1300 through 1304.**

a. Voluntary Solar Resource Development Fund established; administration; permitted uses of money in Fund. § 67-1302.

This Fund is used solely to provide loans for solar energy projects and to reimburse the Department of Mines, Minerals and Energy for its reasonable costs incurred associated with program administration. The Fund’s sources are money voluntarily contributed by customers of electric utilities, other gifts and grants, and loan repayments made to the Fund from eligible borrowers.

b. Use of Moneys in Fund. § 67-1303.

The revolving loan program provides money to “facilitate the construction and acquisition of eligible solar energy projects.” The amount of the loans made eligible for solar projects is determined annually on July 1. The Department of Mines, Minerals, and Energy determines “criteria, guidelines, and requirements for loan eligibility, loan amounts, loan terms, and interest to be charged . . . .”

4. **Green job creation tax credit § 58.1-439.12:05.**

The taxpayer is allowed a tax credit against the tax levied under § 58.1-320 (Individual Income Tax: Imposition of Tax) or § 58.1-400 (Taxation of Corporations: Imposition of Tax) for all new green jobs the taxpayer creates within the state. To qualify, the job’s work activity must directly relate to the field of renewable energy. Each green job with an annual salary that exceeds $50,000, in excess of thirty-five hours a week, forty-eight weeks a year, is permitted a tax credit of $500. The taxpayer’s eligibility for the tax credit requires the job to be filled for at least one year prior to receipt of the credit. Thereafter, the taxpayer is eligible for each of the subsequent four years in which the job is continuously filled. A qualifying taxpayer is permitted the credit for up to 350 green jobs.

However, a taxpayer cannot utilize the tax credit for any green job if the taxpayer is allowed

(i) a major business facility job tax credit pursuant to § 58.1-439 (Major business facility job tax credit) or

(ii) a federal tax credit for investments in manufacturing facilities for clean energy technologies that would foster investment and job creation in clean energy manufacturing.

Notably, if the taxpayer is eligible for the tax credit, and the green job is created in an enterprise zone, an area in which there is a need for special state incentives to spur economic development, the taxpayer may also qualify for additional benefits under the Enterprise Zone
Grant Program. VA. CODE ANN. § 59.1-539 (2005). This program allows for grant funding either

(i) $800 per year for up to five consecutive years for each grant eligible position that during such year is paid a minimum of 200 percent of the federal minimum wage and that is provided with health benefits, or

(ii) $500 per year for up to five years for each grant eligible position that during such year is paid less than 200 percent of the federal minimum wage, but at least 175 percent of the federal minimum wage, and that is provided with health benefits.

VA. CODE ANN. § 59.1-547 (2012)

Additionally, if an enterprise zone experiences an unemployment rate of one and a half times or more of the state average, "the business firm will receive $500 per year for up to five years for each grant eligible position that during such year is paid at least 150 percent of the federal minimum wage and that is provided with health benefits." Id.

5. Incentives for green roofing § 58.1-3852.

Green roofing is defined as a "solar or vegetative roof." A qualifying solar roof must generate at least 2.5% of the total electric energy used by the building. The statute provides that any city county or town can by ordinance "grant incentives or provide regulatory flexibility" in an effort to promote the construction or repair of green roofs. Regulatory flexibility can include a reduction in permit fees, streamlining the permitting process, or a reduction "in any gross receipts tax on green roof contractors."

6. Separate classification of machinery and tools used directly in producing or generating renewable energy § 58.1-3508.6.

This statute delineates between standard tools and machinery identified in § 58.1-3507 and carves out a tax incentive for machinery and tools, including repair and replacement parts, that are used for the production of renewable energy which includes, among other sources, solar energy. As a result, a county, city, or town can levy a different tax that is not in excess to the general class of machinery and tools identified in § 58.1-3507.

7. Certified solar energy equipment, facilities or devices and certified recycling equipment, facilities or devices § 58.1-3661.

Certified solar energy equipment facilities or devices are classified separately from other classifications of real or personal property for local taxation purposes. Certified solar energy equipment facilities or devices means any real or personal property, equipment, facility, or devices which are certified by the local certifying authority (i.e. local building departments or the Department of Waste Management) and designed and used primarily for the collection and use of solar energy for water heating, space heating or cooling, or another purpose that would otherwise use a conventional energy source.
A county, city, or town can adopt an ordinance that wholly or partially exempts the certified solar energy equipment, facilities, or devices from taxation. Any person can apply for the exemption to the local building department. Once the local building department determines the equipment, facility, or device performs the functions relating to the collection and use of solar energy and conforms to the regulations of the Board of Housing and Community Development, the department will approve and certify the application. Thereafter, the local assessing officer determines the value of the certified real or personal property, equipment, facility, or device. That value is applied to the local tax rate and is subtracted, either wholly or partially, from the total real or personal property, equipment, facility, or device value.

The exemption takes effect for the next tax year and is allowed for not less than the next five years.

8. **Classification of improvements to real property designed and used primarily for the manufacture of a renewable energy product for tax purposes § 58.1-3221.4.**

Improvements to real property designed and used primarily for the purposes of manufacturing a product from renewable energy are classified separately for taxation purposes. A county, city, or town may, by ordinance, levy a tax on the value of the improvements at a different rate that is less than the tax rate of the general class of real property.

9. **§ 58.1-3660 Certified pollution control and equipment facilities.**

Certified pollution control equipment and facilities include real or personal property, equipment, facilities, or devices, used primarily for the purpose of abating or preventing pollution of the atmosphere or waters of the Commonwealth. The Department of Mines, Minerals and Energy, serving as the state certifying agency for solar energy projects, must certify to the Department of Taxation the property exists in conformity with the program and requirements. Qualified certified pollution control equipment and facilities are a separate class of property and are exempt from state and local taxation.

For solar photovoltaic systems, this exemption applies only to:

(i) projects equaling 20 megawatts or less, as measured in alternating current (AC) generation capacity, for which an initial interconnection request form has been filed with an electric utility or a regional transmission organization on or before December 31, 2018;

(ii) projects equaling 20 megawatts or less, as measured in alternating current (AC) generation capacity, that serve any of the public institutions of higher education listed in § 23.1-100 or private college as defined in § 23.1-105;

(iii) 80 percent of the assessed value of projects for which an initial interconnection request form has been filed with an electric utility or a regional transmission organization after January 1, 2015, and greater than
20 megawatts, as measured in alternating current (AC) generation capacity, for projects first in service on or after January 1, 2017,

(iv) projects equaling 5 megawatts or less, as measured in alternating current (AC) generation capacity, for which an initial interconnection request form has been filed with an electric utility or a regional transmission organization on or after January 1, 2019, and

(v) 80 percent of the assessed value of all other projects equaling more than 5 megawatts, as measured in alternating current (AC) generation capacity for which an initial interconnection request form has been filed with an electric utility or a regional transmission organization on or after January 1, 2019. The exemption for solar photovoltaic (electric energy) projects greater than 20 megawatts, as measured in alternating current (AC) generation capacity, shall not apply to projects in which construction begins after January 1, 2024. Such property shall not include the land on which such equipment or facilities are located.

10. § 58.1-609.3 Commercial and industrial exemptions.

The tax imposed by this chapter or under §§ 58.1-605 (local sales taxes) and 58.1-606 (local use taxes) does not apply to certified pollution control equipment and facilities that is defined in § 58.1-3660, unless the equipment has not been certified to the Department of Taxation by the Department of Mines, Minerals and Energy.

11. § 67-1504 Federal loan guarantees.

The Virginia Solar Energy Development and Energy Storage Authority may apply to the U.S. Department of Energy for federal loan guarantees available through the Energy Policy Act, 42 U.S.C. § 16511 et seq. or other similar federal legislation in an effort to develop solar energy projects. Any loans received can be allocated in entirety or by portion to third parties by the Virginia Solar Energy Development and Energy Storage Authority under terms and conditions it deems appropriate. Decisions made by the Virginia Solar Energy Development and Energy Storage Authority do not fall under the Administrative Process Act (§ 2.2-4000 et seq.) and are not subject to appeal.

Table of Authorities

FEDERAL


26 U.S.C. § 48 Commercial and utility renewable energy tax credit.
26 U.S.C. § 54D Qualified energy conservation bonds and clean energy conservation bonds.


7 CFR § 1709 Assistance to high energy cost communities.


42 USC Sec. 16511, et. seq Federal loan program.

Modified Accelerated Cost-Recovery System (MACRS).

VIRGINIA

§ 58.1-439.12:05 Green job creation tax credit.

§ 56-585.2 Renewable energy portfolio standard program.

§ 58.1-609.3 Commercial and industrial exemptions.

§ 58.1-3221.4 Classification of improvements to real property designed and used primarily for the manufacture of a renewable energy product for tax purposes.

§ 58.1-3508.6 Separate classification of machinery and tools used directly in producing or generating renewable energy.

§ 58.1-3660 Certified pollution control and equipment facilities.

§ 58.1-3661 Certified solar energy equipment, facilities or devices and certified recycling equipment, facilities or devices.

§ 58.1-3852 Incentives for green roofing.

§ 59.1-539 Enterprise zone grant program.

§ 59.1-547 Enterprise zone job creation grants.

§§ 67-1000 to 1003 Photovoltaic, solar, and wind energy utilization grant program.

§§ 67-1300 to 1304 Voluntary solar resource fund development.

§ 67-1504 Federal loan guarantees.
OTHER AUTHORITY


Attachment 5 – Table of Key Federal Interconnection Laws and Regulations
**Source:** NREL (2016). *Table 3 Summary of Key Federal Interconnection Laws and Regulations*

<table>
<thead>
<tr>
<th>Laws and Regulations</th>
<th>Year</th>
<th>Key Points</th>
<th>Key Implications for Renewable Energy Interconnections</th>
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<tbody>
<tr>
<td>Federal Power Act (FPA)</td>
<td>1935 (subsequently amended numerous times)</td>
<td>Federal Power Commission established to oversee wholesale and interstate electricity transactions Continues to be the primary source of federal authority over electric utilities.</td>
<td>Beginning of federal oversight of the power sector</td>
</tr>
<tr>
<td>Public Utility Regulatory Policy Act (PURPA)</td>
<td>1978 (amended in 2005)</td>
<td>Utilities required to buy electricity from qualifying facilities, injecting competition into wholesale power markets.</td>
<td>Foundational policy that paved the way for small non-utility generators to enter the market, including renewable energy developers</td>
</tr>
<tr>
<td>FERC Orders 888 &amp; 889 Open Access Transmission and OASIS</td>
<td>1996</td>
<td>Codified the OATT Established the Open Access Same-Time Information System (OASIS)</td>
<td>Reduced transmission barriers for renewable energy generators, enabling renewable energy plants to choose among wholesale buyers Gave renewable energy developers open access to market-critical data including transmission capacity and prices</td>
</tr>
<tr>
<td>FERC Order 2000 Regional Transmission Organizations</td>
<td>1999</td>
<td>Transmission utilities strongly encouraged to join an RTO/ISO Describes characteristics and functions required for entities to become an RTO</td>
<td>Larger balancing areas and real-time balancing better enable higher penetrations of variable renewable energy generation</td>
</tr>
<tr>
<td>Laws and Regulations</td>
<td>Year</td>
<td>Key Points</td>
<td>Key Implications for Renewable Energy Interconnections</td>
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<tr>
<td>FERC Orders 2003 &amp; 661</td>
<td>2003, 2005</td>
<td>Standard interconnection procedures for large generators (&gt;20 MW)</td>
<td>Reduced the timeframe and cost of interconnection for large renewable energy generators</td>
</tr>
<tr>
<td>Interconnection Procedures for Large Generators</td>
<td></td>
<td>Codified interconnection standards for wind generators</td>
<td>Required low voltage ride-through, reactive power, and SCADA capability in wind plants</td>
</tr>
<tr>
<td>FERC Order 2006 &amp; 792</td>
<td>2005, 2013</td>
<td>Standard interconnection procedures for small generators (&lt;20 MW)</td>
<td>Reduced the timeframe and cost of interconnection for small renewable energy generators</td>
</tr>
<tr>
<td>Interconnection Procedures for Small Generators</td>
<td></td>
<td></td>
<td>Established a fast-track process for small renewable energy systems</td>
</tr>
<tr>
<td>Energy Policy Act of 2005</td>
<td>2005</td>
<td>Terminated long-term PURPA contracts, abandoned the avoided cost rate principle, and provided tax incentives for transmission system improvements</td>
<td>Increased competition in wholesale power markets by forcing out uneconomical projects</td>
</tr>
<tr>
<td>FERC Orders 890 &amp; 1000</td>
<td>2007, 2011</td>
<td>Transmission providers required to conduct transmission planning at the regional and local level Added flexibility to methods of cost allocation of transmission upgrades</td>
<td>Improved transmission planning reduces grid congestion and promotes access to new sources of energy, including solar and wind resources Broad allocation of transmission upgrade costs reduces financial burden for renewable energy plants</td>
</tr>
<tr>
<td>Transmission Planning and Cost Allocation</td>
<td></td>
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</tr>
<tr>
<td>FERC Order 764</td>
<td>2012</td>
<td>Required transmission owners to provide 15-minute scheduling</td>
<td>Enabled renewable energy generators to better respond to resource variability in their power delivery schedules</td>
</tr>
<tr>
<td>Integration of Variable Energy Resources</td>
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<tr>
<td>FERC Order 784</td>
<td>2013</td>
<td>Amended ancillary services markets to include “pay-for-performance” pricing based on speed and precision</td>
<td>Increased opportunities and incentives for energy storage to participate in ancillary services markets</td>
</tr>
<tr>
<td>Laws and Regulations</td>
<td>Year</td>
<td>Key Points</td>
<td>Key Implications for Renewable Energy Interconnections</td>
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<tr>
<td>FERC Orders 819 &amp; 827</td>
<td>2015, 2016</td>
<td>Established rules to foster competition in the Primary Frequency Response market</td>
<td>Enabled RE generators to receive market-based rates for provision of Primary Frequency Response services</td>
</tr>
<tr>
<td>Primary Frequency Response and Reactive Power</td>
<td></td>
<td>Removed exemptions for wind generators to provide reactive power to the transmission system</td>
<td>Required wind generators to have equipment capable of providing reactive power</td>
</tr>
</tbody>
</table>
Attachment 6 – 9VAC15-60-30

A. The owner or operator of a small solar energy project with a rated capacity greater than five megawatts and a disturbance zone greater than 10 acres, provided that the project does not otherwise meet the criteria for Part III (9VAC15-60-130 A or B) of this chapter, shall submit to the department a complete application in which he satisfactorily accomplishes all of the following:

1. In accordance with § 10.1-1197.6 B 1 of the Code of Virginia, and as early in the project development process as practicable, furnishes to the department a notice of intent, to be published in the Virginia Register, that he intends to submit the necessary documentation for a permit by rule for a small renewable energy project;

2. In accordance with § 10.1-1197.6 B 2 of the Code of Virginia, furnishes to the department a certification by the governing body of the locality or localities wherein the small renewable energy project will be located that the project complies with all applicable land use ordinances;

3. In accordance with § 10.1-1197.6 B 3 of the Code of Virginia, furnishes to the department copies of all interconnection studies undertaken by the regional transmission organization or transmission owner, or both, on behalf of the small renewable energy project;

4. In accordance with § 10.1-1197.6 B 4 of the Code of Virginia, furnishes to the department a copy of the final interconnection agreement between the small renewable energy project and the regional transmission organization or transmission owner indicating that the connection of the small renewable energy project will not cause a reliability problem for the system. If the final agreement is not available, the most recent interconnection study shall be sufficient for the purposes of this section. When a final interconnection agreement is complete, it shall be provided to the department. The department shall forward a copy of the agreement or study to the State Corporation Commission;

5. In accordance with § 10.1-1197.6 B 5 of the Code of Virginia, furnishes to the department a certification signed by a professional engineer licensed in Virginia that the maximum generation capacity of the small solar energy project, as designed, does not exceed 150 megawatts;
6. In accordance with § 10.1-1197.6 B 6 of the Code of Virginia, furnishes to the department an analysis of potential environmental impacts of the small renewable energy project's operations on attainment of national ambient air quality standards;

7. In accordance with § 10.1-1197.6 B 7 of the Code of Virginia, furnishes to the department, where relevant, an analysis of the beneficial and adverse impacts of the proposed project on natural resources. The owner or operator shall perform the analyses prescribed in 9VAC15-60-40. For wildlife, that analysis shall be based on information on the presence, activity, and migratory behavior of wildlife to be collected at the site for a period of time dictated by the site conditions and biology of the wildlife being studied, not exceeding 12 months;

8. In accordance with § 10.1-1197.6 B 8 of the Code of Virginia, furnishes to the department a mitigation plan pursuant to 9VAC15-60-60 that details reasonable actions to be taken by the owner or operator to avoid, minimize, or otherwise mitigate such impacts, and to measure the efficacy of those actions; provided, however, that the provisions of this subdivision shall only be required if the department determines, pursuant to 9VAC15-60-50, that the information collected pursuant to § 10.1-1197.6 B 7 of the Code of Virginia and 9VAC15-60-40 indicates that significant adverse impacts to wildlife or historic resources are likely. The mitigation plan shall be an addendum to the operating plan of the solar energy project, and the owner or operator shall implement the mitigation plan as deemed complete and adequate by the department. The mitigation plan shall be an enforceable part of the permit by rule;

9. In accordance with § 10.1-1197.6 B 9 of the Code of Virginia, furnishes to the department a certification signed by a professional engineer licensed in Virginia that the project is designed in accordance with 9VAC15-60-80;

10. In accordance with § 10.1-1197.6 B 10 of the Code of Virginia, furnishes to the department an operating plan that includes a description of how the project will be operated in compliance with its mitigation plan, if such a mitigation plan is required pursuant to 9VAC15-60-50;

11. In accordance with § 10.1-1197.6 B 11 of the Code of Virginia, furnishes to the department a detailed site plan meeting the requirements of 9VAC15-60-70;

12. In accordance with § 10.1-1197.6 B 12 of the Code of Virginia, furnishes to the department a certification signed by the applicant that the small solar energy project has applied for or obtained all necessary environmental permits;

13. In accordance with § 10.1-1197.6 H and I of the Code of Virginia, furnishes to the department a certification signed by the applicant that the small solar energy project is being proposed, developed, constructed, or purchased by a person that is not a utility regulated pursuant to Title 56 of the Code of Virginia or provides certification that (i) the project’s costs are not recovered from Virginia jurisdictional customers under base rates, a fuel factor charge, or a rate adjustment clause, or (ii) the applicant is a utility aggregation cooperative formed under Article 2 (§ 56-231.38 et seq.) of Chapter 9.1 of Title 56 of the Code of Virginia;
14. Prior to authorization of the project and in accordance with § 10.1-1197.6 B 13 and B 14 of the Code of Virginia, conducts a 30-day public review and comment period and holds a public meeting pursuant to 9VAC15-60-90. The public meeting shall be held in the locality or, if the project is located in more than one locality, in a place proximate to the location of the proposed project. Following the public meeting and public comment period, the applicant shall prepare a report summarizing the issues raised by the public and include any written comments received and the applicant’s response to those comments. The report shall be provided to the department as part of this application; and

15. In accordance with 9VAC15-60-110, furnishes to the department the appropriate fee.

B. Within 90 days of receiving all of the required documents and fees listed in subsection A of this section, the department shall determine, after consultation with other agencies in the Secretariat of Natural Resources, whether the application is complete and whether it adequately meets the requirements of this chapter pursuant to § 10.1-1197.7 A of the Code of Virginia.

1. If the department determines that the application meets the requirements of this chapter, then the department shall notify the applicant in writing that he is authorized to construct and operate a small solar energy project pursuant to this chapter.

2. If the department determines that the application does not meet the requirements of this chapter, then the department shall notify the applicant in writing and specify the deficiencies.

3. If the applicant chooses to correct deficiencies in a previously submitted application, the department shall follow the procedures of this subsection and notify the applicant whether the revised application meets the requirements of this chapter within 60 days of receiving the revised application.

4. Any case decision by the department pursuant to this subsection shall be subject to the process and appeal provisions of the Administrative Process Act (§ 2.2-4000 et seq. of the Code of Virginia).

Statutory Authority
§ 10.1-1197.6 of the Code of Virginia.

Historical Notes
Attachment 7 – Shawsboro Solar
Shawsboro Solar – 20MW
Currituck, North Carolina
Image 1. Adjacent elementary school entrance to solar farm.
Image 2. Vegetative buffer, perimeter fencing, and rows of solar arrays.
Image 3. Setback from road and vegetative buffer.
Attachment 8 – Wildwood Solar
Wildwood Solar – 120MW
Currituck, North Carolina
Image 1. Internal access road and transmission infrastructure.
Image 2. Internal access road, perimeter fencing, and solar arrays.
Image 3. Vegetative buffer and earthen berm around perimeter of site.
Image 4. Vegetative buffer and earthen berm around perimeter of site.
Attachment 9 – Woodland Solar
Woodland Solar – 19 MW

Isle of Wight, Virginia
Image 1. Row of photovoltaic (PV) panels.
Image 2. Row of PV panels on single-axis tracking mechanism.
Image 4. Electrical inverter.
Image 5. Electrical Inverter and PV panels.
Image 6. Row of PV panels
Image 7. Newly seeded groundcover adjacent to row of PV panels.
Image 8. Perimeter fencing and vegetative buffer.
Image 10. Existing agricultural field adjacent to solar farm.