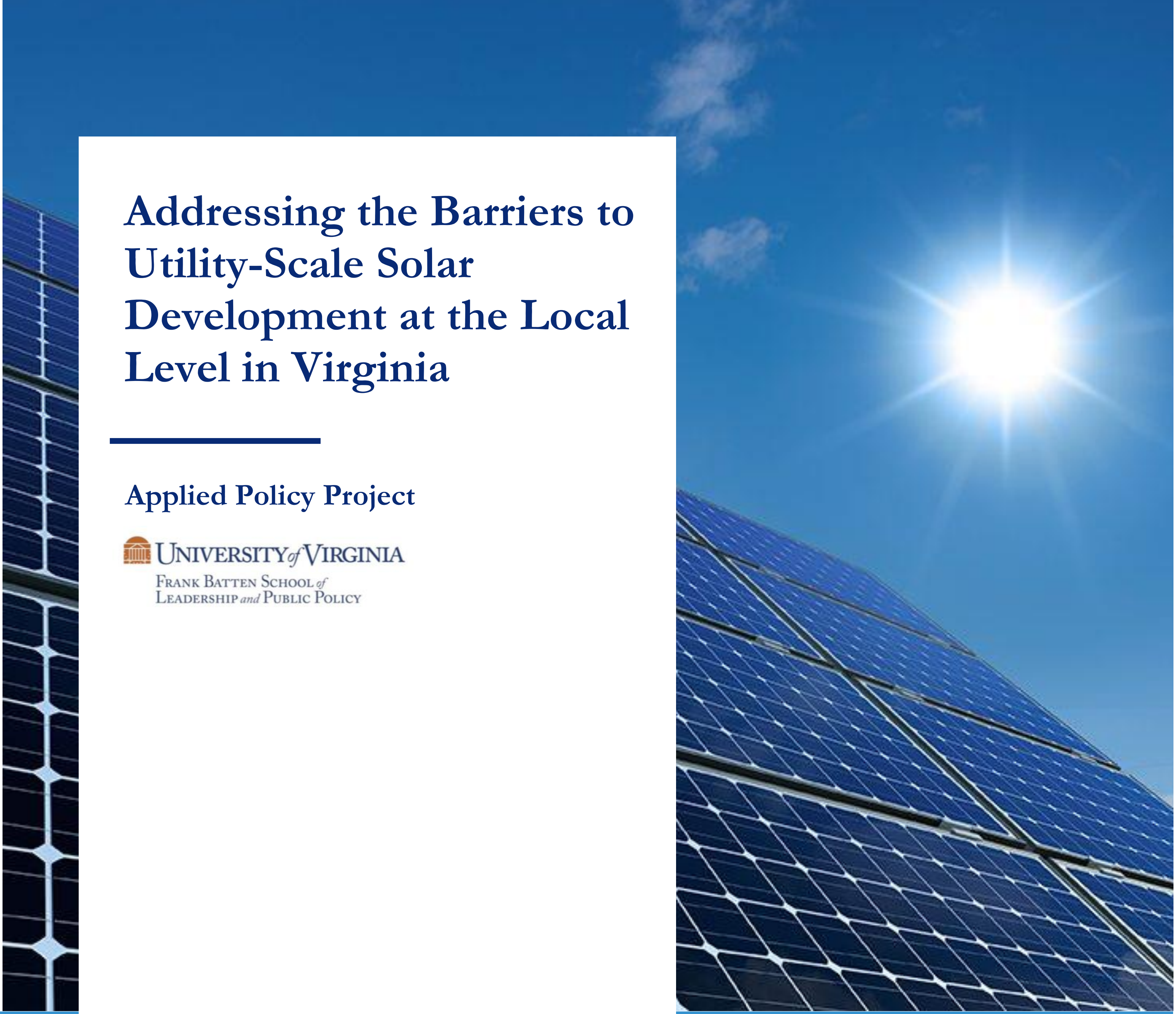


Addressing the Barriers to Utility-Scale Solar Development at the Local Level in Virginia

Applied Policy Project

University of Virginia
Frank Batten School of Leadership and Public Policy

MAY 2020

Prepared for:
Chesapeake Solar & Storage Association
Authored by: Daniel Krug

Disclaimer

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, or by any other agency.

Honor Pledge

On my honor as a student, I have neither received nor given aid on this assignment.

Daniel Krug

Client Overview

The Chesapeake Solar & Storage Association (CHESSA) represents the interests of developers, installers, manufacturers, distributors, and component suppliers serving Maryland, Virginia, Delaware, and the District of Columbia. Their goal is to deliver on policy formation and advocacy, market representation, networking, education, and additional benefits for their members. They publish quarterly newsletters; host annual solar energy conferences, workshops and webinar series; and create targeted industry reports and analyses for their members.

Acknowledgements

I would like to thank David Murray, Executive Director at Chesapeake Solar and Storage Association, for helping throughout the process of this project. His comments and guidance were incredibly invaluable and I greatly appreciate his help.

Thank you to my advisors, Raymond Scheppach and Brad Carson; your comments and guidance have helped me shape my report and made my views for this project a reality.

I would also like to thank Bill Shobe and Elizabeth Marshall. They selflessly provided me with their time and knowledge to help make my project even better.

Finally, thank you to my friends and family who have been incredibly supportive of me throughout my time at UVA and Batten. Without your love and support I would not be where I am today.

Table of Contents

Acronyms and Definitions

Renewable Energy Specific Terms
c-Si – Crystalline silicon
CSP – Concentrating Solar Thermal Power
CVT – Concentrating Photovoltaic Technology
ESS – Energy Storage System
GW - Gigawatt
kWh – Kilowatt hour
MW – Megawatt
MWh – Megawatt hour
PV – Photovoltaic
USS – Utility Scale Solar

Organizations
CHESSA – Chesapeake Solar and Storage Association
DEQ – Department of Environmental Quality
DMME – Department of Mines, Minerals, and Energy
FERC – Federal Energy Regulatory Commission
SEIA – Solar Energy Industries Association

Legislative/Procedural Terms
ITC – Investment Tax Credit
PBR – Permit By Right
PURPA – Public Utility Regulatory Policies Act
QF – Qualifying Facilities
RPS – Renewable Portfolio Standard
VCEA – Virginia Clean Economy Act

Other Terms
NIMBY – "Not In My Backyard"
GHG – Greenhouse Gas

Executive Summary

Utility-scale solar (USS) energy is becoming an increasingly efficient and cost-competitive electricity generation source. However, Virginia is not generating enough electricity from renewable sources, especially from USS projects. With the signing of the Virginia Clean Economy Act (VCEA), the state has set incredibly ambitious goals for decommissioning conventional generation sources and acquiring or constructing new renewable sources. Virginia has pledged to install a total of 16,000 megawatts (MW) in renewable energy sources in the public interest, a 220% increase from the 5,000 MW previously pledged (*LIS > Bill Tracking > HB1526 > 2020 Session*, n.d., p. 15). With the price of photovoltaic (PV) cells dropping from $76 per watt in 1977 to $0.30 per watt as of 2015, utility-scale PV solar facilities are becoming increasingly attractive (Gul et al., 2016; Kannan & Vakeesan, 2016; Malinowski et al., 2017). Solar energy sources provide environmental benefits such as minimal greenhouse gas (GHG) emissions throughout the 'life-cycle' of the project, and minimal water pollution risks, as well as economic benefits in the form of increased revenue to localities (either through taxes or a revenue share ordinance), additional capital resources gained from siting agreements, and an increased number of jobs.

Despite the numerous benefits that USS projects provide, there are still barriers to their adoption. Beyond the technical barriers of technological and legislative issues, they also face non-technical barriers like issues with social acceptance. While the general public perception of renewable energy sources may be positive, renewable energy project proposals face opposition (sometimes fierce and organized) at the local level.

It is essential that social support for renewable energy projects increases so that Virginia will be able to meet their ambitious renewable energy goals. Provided in this report is a number of alternatives that CHESSA could adopt to make positive change on this issue. The alternatives are as follows:

1. Allow present trends to continue.
2. Advocate for solar development that is more palatable for local residents.
3. Create an educational series, hosted by DMME, that provides county-specific webinars on their current solar policies, how they can take advantage of siting agreements with solar developers, and how to utilize the new revenue share legislation. CHESSA would support the series and serve as a resource for answering questions.
4. Create a resource bank for solar developers that pool together facts and trusted information on how to address and rebut common claims that community members make against USS projects.

These alternatives were evaluated against the following criteria: effectiveness, cost, feasibility (both administrative and political), and equity.

This analysis recommends that CHESSA pursues <u>Alternative 3: Creating an educational series with county-specific webinars</u>. This alternative had the highest effectiveness and equity amongst the other alternatives, while also have relatively high administrative and political feasibility. There is a tradeoff with cost, since this alternative would require additional staff time and monetary expenses for CHESSA. However, the potential benefits outweigh the potential costs, making this alternative an attractive choice. CHESSA would be able to reach a wide range of localities and community members in Virginia and provide them with opportunities to learn about the benefits of USS projects.

Introduction

The Climate Problem

The crisis of climate change has been steadily evolving and its effects are being felt worldwide. The Earth is warming at an alarming rate, with the temperatures rising over the past 50 years nearly twice as fast than in the last 100 years (*NASA - The Ups and Downs of Global Warming*, n.d.). Evidence is pointing towards climate change due to anthropogenic factors as the cause for these increased warming trends. According to the Intergovernmental Panel on Climate Change, the period between 1983 and 2012 was likely the warmest 30 years in the Northern Hemisphere in the last 1400 years (IPCC, 2014). During this time, global temperatures, sea level, and greenhouse gas (GHG) concentrations have been rising and there is a strong link to anthropogenic causes. Emissions of CO_2 from fossil fuels and industrial processes account for around 78% of the total GHG emissions increase from 1970 to 2010 (IPCC, 2014).

Failure to address the issue of carbon-emitting energy sources would result in costs to human health. Specifically, continued air pollution can lead to health effects ranging from minor upper respiratory irritation to chronic respiratory and health disease, lung cancer, and many more adverse effects (Kampa & Castanas, 2008). Additionally, the use of fossil fuels have an effect on the Earth's climate through rising temperatures, changing weather patterns, and other potential disasters (Caldeira et al., 2003; Wuebbles & Jain, 2001).

Why renewable energy?

Approximately 29% of the United States' greenhouse gas emissions come from the electricity sector, the most prevalent of these GHGs being CO_2 (*How Much of U.S. Carbon Dioxide Emissions Are Associated with Electricity Generation?*, 2017; US EPA, 2016). Burning natural gas for electricity produces between 0.6 and 2 pounds of CO2e[1] per kWh. For coal the range is between 1.4 and 3.6 pounds of CO2e/kWh (*Benefits of Renewable Energy Use | Union of Concerned Scientists*, n.d.). When compared to these conventional sources, renewable energy sources produce minimal global warming emissions. This even considers

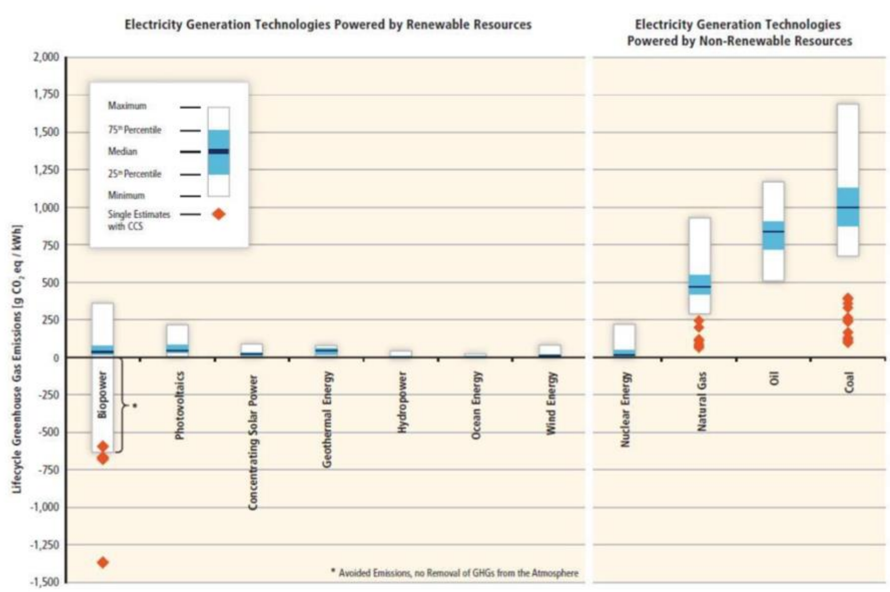


Figure 1 GHG emissions over the life-cycle of different electricity generating sources. Source: (*Benefits of Renewable Energy Use | Union of Concerned Scientists*, n.d.)

[1] CO_2 equivalent (CO2e): the number of metric tons of CO_2 emissions with the same global warming potential as one metric ton of another greenhouse gas

all of the "life-time emissions" of renewable sources, which include emissions from manufacturing, installation, operation, and decommissioning. Solar energy only releases between 0.07 and 0.2 pounds of CO_2e/kWh (*Benefits of Renewable Energy Use | Union of Concerned Scientists*, n.d.). Replacing conventional sources with renewables would greatly reduce GHG emissions in the electricity sector. Studies and models show that if an ambitious renewable electricity standard is set, there could be significant reductions in GHG emissions from the electricity sector (*Clean Energy, Green Jobs | Union of Concerned Scientists*, 2009; Hand et al., 2012).

Renewable energy sources would also provide increased air and water quality benefits. Since renewable sources do not release air pollutants, there is no concern for adverse health impacts or air quality. Renewable sources do not require extensive water resources for cooling and also have no risk of polluting local waterways during operation. However, there is a minor risk of water pollution during construction (*Benefits of Renewable Energy Use | Union of Concerned Scientists*, n.d.).

Beyond the environmental benefits that renewable sources provide, they also produce job opportunities and economic benefits. In 2016 alone, solar employed more than 260,000 people and is projected to continue to create more job opportunities (*Benefits of Renewable Energy Use | Union of Concerned Scientists*, n.d.; *Clean Energy, Green Jobs | Union of Concerned Scientists*, 2009; Long & Steinberger, 2016). They would also provide local governments with increased tax revenue, can help stabilize energy prices, and provide a more resilient and reliable form of energy that can operate under extreme weather conditions (*Benefits of Renewable Energy Use | Union of Concerned Scientists*, n.d.; Long & Steinberger, 2016).

Background

Renewable Energy

Renewable energy technology has been greatly improving in the past few decades. The efficiency of renewable sources has been greatly improving and the manufacturing costs are steadily decreasing. Of the available renewable energy sources, one of the most promising and cost-effective alternatives is solar energy (Kannan & Vakeesan, 2016; Mangum et al., 2020). There are three solar technologies that are utilized to generate electricity from solar radiation: photovoltaic (PV), concentrating solar thermal power (CSP), and concentrating photovoltaic technology (CVT). Photovoltaic modules are solid-state semiconductors that convert sunlight into electricity. Concentrating solar technology utilizes lens and/or mirrors to focus sunlight from a large area into a small area to generate electricity (Devabhaktuni et al., 2013). Of these solar technologies, the one that has seen the most growth in the industry has been the photovoltaic systems (Kannan & Vakeesan, 2016). PV systems have many advantages over the other solar technologies and fossil fuel sources; these include clean energy conversion, easy design and installation, better architectural visibility, longer lifetime with less maintenance requirements, easy transportation, and acceptable prices with a significantly dropping rate (Malinowski et al., 2017).

Cost and Technology Trends

Looking at the levelized cost of energy (LCOE)[2] across the different sources, solar energy is one of the cheapest options available. According to Lazard, the LCOE of solar PV (both thin-film and crystalline modules) is around $35.5 on average. Comparatively, coal's LCOE is around $112 on average, while natural gas has an LCOE around $58.5 on average (Ray, 2017). Specifically for solar technology, the price per watt of a PV solar cell has dropped from around $76 per watt in 1977 prices to around $0.30 per watt as of 2015 (Gul et al., 2016; Kannan & Vakeesan, 2016; Malinowski et al., 2017). The decline in prices for PV solar modules is largely due to innovations in material technology, increases in amount of production, improvements in the efficiency by innovative technology, increasing lifespan of PV systems, and favorable policies for solar technology (Gul et al., 2016). The photovoltaic effect was discovered in the 19th century and since then, the efficiency of PV solar cells has been steadily increasing. The most common

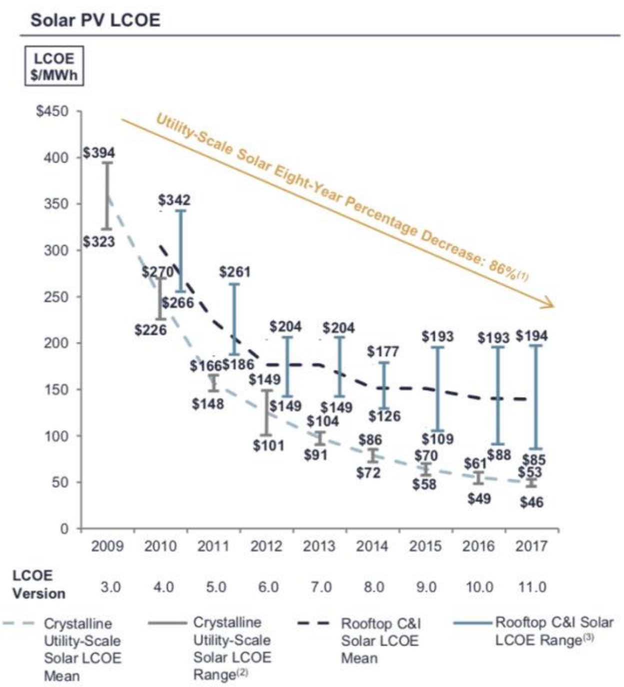


Figure 2 Trend of levelized cost of energy for solar PV cells from 2009 to 2017. Source: (Ray, 2017)

[2] Levelized Cost of Energy (LCOE): a measure of the average net present cost of electricity generation for a generating plant over its lifetime

solar cell material used in PV systems is crystalline silicon (c-Si), followed by thin-film technology. c-Si and thin-film cells are the only technologies that are available in mass production for civilian use (Shubbak, 2019). The technologies for c-Si and thin-film solar cells have constantly been in research and development to improve their efficiency at generating electricity, the life-time of the cell, and the manufacturing process (Gul et al., 2016). Some emerging technologies that may eventually be more efficient and cost-effective than c-Si solar cells are multi-junction cells, cells created from organic material, and dye-sensitive solar cells (Gul et al., 2016; Malinowski et al., 2017; Shubbak, 2019). Another important technology for PV solar systems that is being improved upon is energy storage systems (ESS). With developments in ESS, PV systems can become more self-sustaining and would not have to rely on non-traditional sources to supplement additional energy when PV systems cannot meet the energy demand (Malinowski et al., 2017).

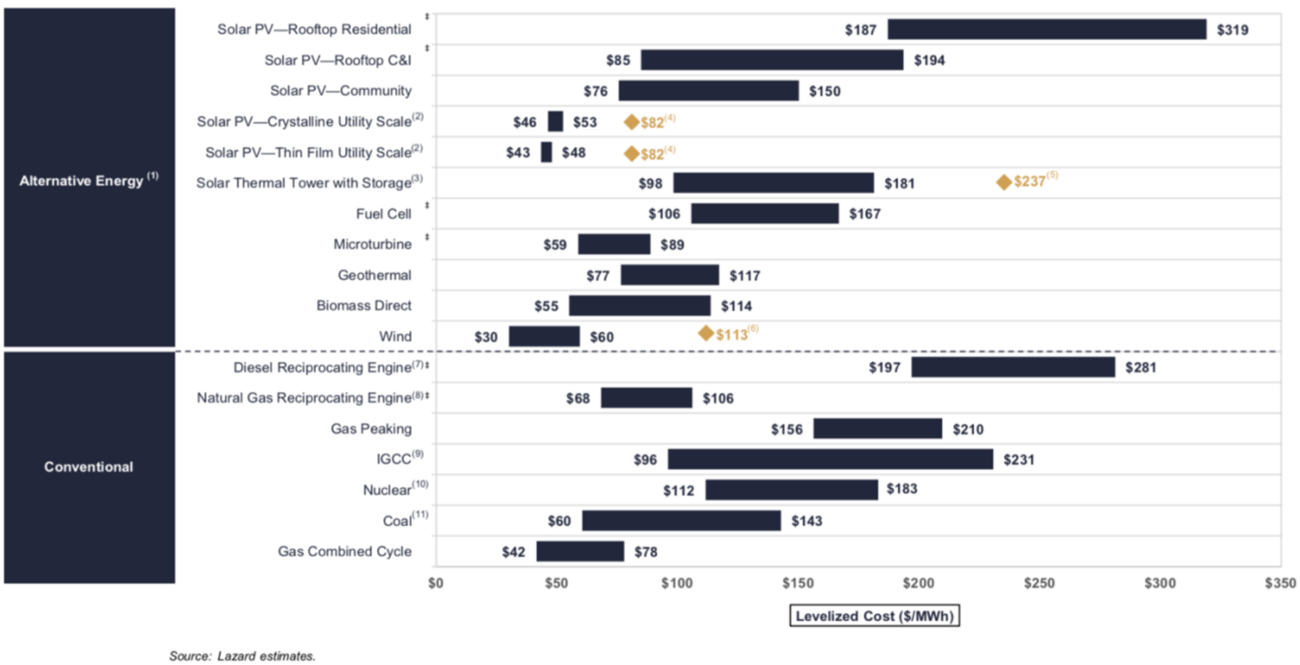


Figure 3 Comparison of the unsubsidized levelized cost of energy for different electricity generating sources. Source: (Ray, 2017)

Amount of Solar Installation in the US and Virginia

The United States

With declining prices and improvements in technology, the amount of installed solar capacity in the US has increased drastically since 2008. The national amount of electricity generated from USS facilities increased from 0.9 million MWh in 2008 to 63.8 million MWh in 2018, a 7,284% increase in the past 10 years. (Mangum et al., 2020). During this period, the average annual growth rate was almost 50% and there is now over 85 gigawatts (GW) of installed solar capacity nationwide (*Solar Industry Research Data*, n.d.). A large majority of the solar installations in recent years have been at the utility scale. USS represents around 60% of the installed solar capacity in 2019, while residential and non-residential systems constitute the other 40% (*Solar Industry Research Data*, n.d.).

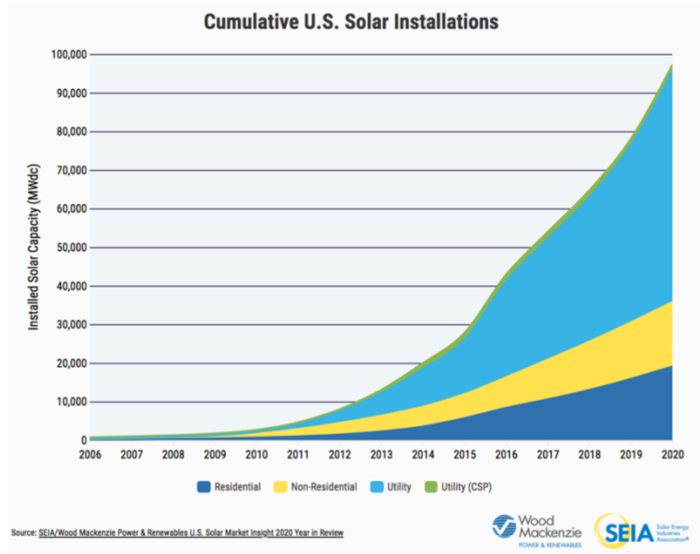


Figure 4 Trend of solar installations in the US from 2006 to 2020. Source: (*Solar Industry Research Data*, n.d.)

The Commonwealth of Virginia

In the past 5 years in Virginia, there has been a massive increase in installed solar projects. In 2015, there was around 50 MW of solar capacity installed between utility-scale, residential, and non-residential systems. As of Q2 of 2020, there is now over 1,000 MW of solar capacity installed (*Virginia Solar*, n.d.). Under currently planned policies, Virginia is projected to see an increase of over 4,000 MW of solar over the next 5 years (*Virginia Solar*, n.d.). Compared to neighbors North Carolina (projected growth of around 3,600 MW over the next 5 years) and Maryland (projected growth of around 1,200 MW over the next 5 years), Virginia's solar policies and incentives have set them up relatively well to grow their solar capacity (*Maryland Solar*, n.d.; *North Carolina Solar*, n.d.).

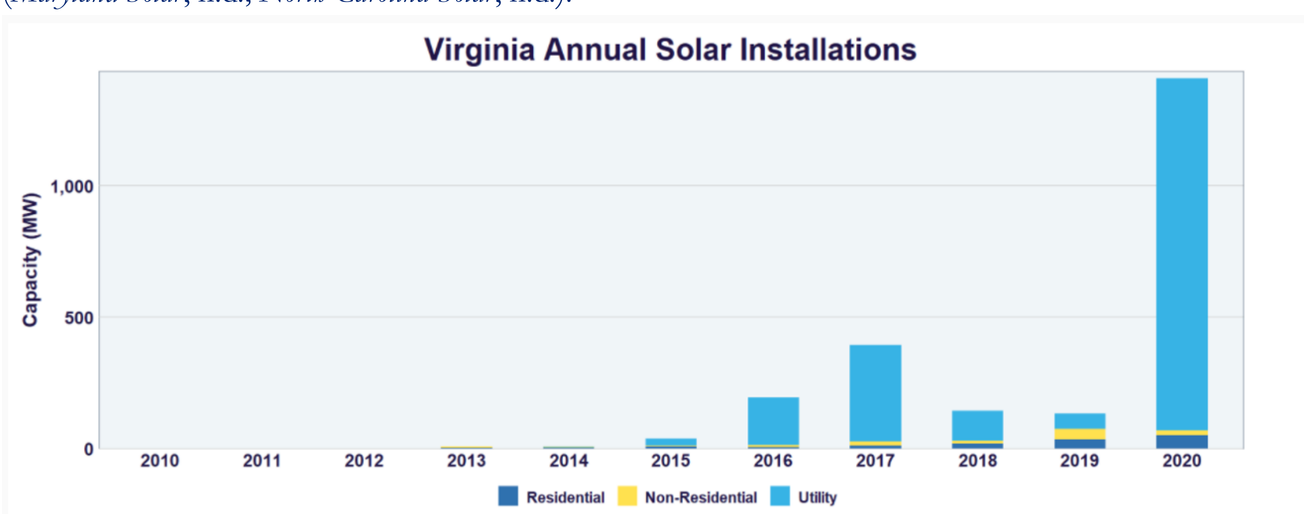


Figure 5 Annual amount of solar installations (by year) in Virginia from 2010 to 2020. Source: (*Virginia Solar*, n.d.)

Federal Policies and Funding Mechanisms

To stimulate growth in the solar industries, countries (and states) utilize regulatory policies and financial incentives to encourage investment in solar energy sources. Some of the top solar generating countries like China, Japan, Germany, and the UK utilize policies, programs, feed-in tariffs, and financial incentives like loan, loan guarantees and grant programs to bolster investments in solar energy (Gul et al., 2016). In the United States, the federal government doesn't provide a national regulatory policy on solar energy like other countries do. However, they do provide financial incentives to both residential and non-residential solar system owners in the forms of tax credits, exemptions and deductions, as well as loan and grant programs (*DSIRE*, n.d.).

The most successful financial incentive the US federal government has utilized has been the Solar Investment Tax Credit (ITC). Since its inception in 2006, the residential and non-residential solar industry has grown by more than 10,000%. The ITC received a multi-year extension from Congress in 2015 and provided market certainty for companies looking to develop long-term investments (*Solar Investment Tax Credit (ITC)*, n.d.). The ITC works as a dollar-for-dollar reduction in income taxes of the person or company that owns the solar system being constructed. The credit is based upon the amount invested, and the credit rate is dependent upon the year that the construction of the solar system was commenced. In 2019, the credit rate was 30%, it decreased to 26% in 2020, and will continue to depreciate until 2022; when commercial and utility-scale projects will receive a 10% credit rate, while residential projects will receive no credit (*Solar Investment Tax Credit (ITC)*, n.d.).

Another federal policy that affects renewable energy sources (especially solar energy) is the Public Utilities Regulatory Policies Act (PURPA). This Act was passed to encourage fuel diversity through alternative energy sources and introduce competition to the electricity sector. It comes in the form of FERC-approved "qualifying facilities" (QFs). PURPA provides QFs with the right to interconnect with a utility-controlled grid and requires utilities to purchase the QFs energy (mandatory purchase obligation) and capacity at the "avoided cost"[3] (*PURPA 101*, n.d.; *PURPA Tracker*, n.d.). This part of the Act was amended by the Energy Policy Act of 2005 and made it so that utilities in competitive wholesale markets did not have mandatory purchase obligations for QFs with a capacity higher than 20 MW (*PURPA 101*, n.d.; *PURPA Tracker*, n.d.). PURPA is a good offer for solar developers due to the dropping price of solar, it is predicted that the Act will drive USS installation in the coming years (*PURPA 101*, n.d.).

With the recent election and the beginning of a Biden Administration that wants to make big strides in renewables and clean energy, there may be an onset of stronger federal policies for renewables. However, for the most part the federal governments leaves creating incentives for solar development to the states.

---

[3] The "avoided cost" is what is would have cost the utility to generate or contract for the energy and capacity in the absence of the QF (*PURPA 101*, n.d.)

Virginia Policies and Funding Mechanisms

Setting policies pertaining to renewable energy is the responsibility of the states. The regulations and financial incentives that are provided at the state level vary depending on the state. For the most part, states adopt renewable energy portfolio standards, provide public benefit funds for renewable energy, establish interconnection standards, and have a multitude of financial incentives for renewable energy (US EPA, 2017). Virginia has adopted some of these policies and funding mechanisms and the relevant ones are described in the table below (*DSIRE*, n.d.; Nowak et al., n.d.):

Regulatory Policy	**Explanation**
Revenue Share Ordinance (SB 762/HB 1131, 2020 Session)	Authorizes any locality to establish an ordinance that sets up a revenue share of up to $1,400 per MW on any solar PV project. Exemptions and additional information can be seen here: https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+HB1131
Siting Agreements (HB 1675, 2020 Session)	Any applicant for a solar facility in a locality must notify that locality of their intent and request a meeting. They are then to meet and negotiate a siting agreement that may include (but is not limited to) terms and conditions such as: - Mitigation of project impacts - Financial compensation - Assistance in deployment of broadband Additional information can be found here: https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+HB1675
Financial Incentives	**Explanation**
Local Option – Renewable Energy Machinery and Tools Property Tax Exemption (HB 1297, 2015 Session)	Provides localities with the option to impose a different property tax on renewable energy generating machinery and tools than other normal use machinery. Additional information can be found here: https://lis.virginia.gov/cgi-bin/legp604.exe?151+sum+HB1297

Prior to 2020, the Virginia renewable energy portfolio standard (RPS) was only voluntary. It required each investor-owned utility to self-report their efforts to reach the goals set by the RPS. Those goals were to reach 7% of retail electricity sales from renewable energy sources by 2017 and 15% by 2025 (*Virginia | Midmarket Solar Policies in the United States | Solar Research | NREL*, n.d.). However, Virginia passed a new, mandatory RPS in the 2020 legislative session called the Virginia Clean Economy Act (VCEA). The Act states that Dominion Energy Virginia and American Electric Power must eventually retire their electric generating sources that emit carbon and must either construct, acquire, or enter into agreements to purchase generating capacity using energy from wind or solar (*LIS > Bill Tracking > HB1526 > 2020 Session*, n.d.). The Act also states that Dominion Energy Virginia and American Electric Power must produce their electricity from 100% renewable sources by 2045 and 2050, respectively. Either utility that does not meet the deadline must pay a deficiency payment or purchase renewable energy certificates. The money from these payments will go towards improving job training, renewable energy programs, energy efficiency measures, and administrative costs (*LIS > Bill Tracking > HB1526 > 2020 Session*, n.d.). Additionally, the two utilities must invest in energy storage capacity and set energy efficiency standards to achieve incremental savings. The VCEA also increased the amount of MW in renewable energy sources in the public interest from 5,000 to 16,000 MW from solar facilities (*LIS > Bill Tracking > HB1526 > 2020 Session*, n.d.). It also established that the State Corporate Commission, the Department of Environmental Quality, the Department of Mines, Minerals, and Energy, the Virginia Council of Environmental Justice, and other applicable state agencies ensure that the renewable energy programs, job training programs, and placement of renewable facilities consider low-income geographic areas and historically disadvantaged communities that are located near previous fossil fuel facilities and coal mines (*LIS > Bill Tracking > HB1526 > 2020 Session*, n.d.). The Virginia Clean Economy Act set ambitious renewable energy goals for the state and paved the way for a new wave of solar systems to be installed.

Solar Permitting Process

There are multiple steps that a project developer must meet before they can receive a solar permit and begin construction and operation of a solar facility. This process is normally very messy and there is no clear step-by-step guideline for developers. The first set of approvals that developers must receive are from the locality in which they intend to construct their project, the state, and from their Regional Transmission Organization (RTO).

The first few steps can be done concurrently, but for the most part developers submit their projects to the RTO first. In Virginia, developers submit their projects to the PJM interconnect queue (takes between 6 months to years). Sometime, being reviewed by PJM is not required for local approval, but it is needed to receive a PBR (E. Marshall, personal communication, Feb. 23, 2021).

Another step for receiving a solar permit is to meet the local permitting requirements. These requirements vary depending on state and local government, as well as the type and size of the system being installed (*Local Solar Permitting*, n.d.; "Solar Permitting And Inspections," 2019). Local plans for zoning and development typically fall into three categories:

1. Comprehensive plans: provide a framework for a community's growth for 20-25 years. Provide legal basis for zoning and land use regulations.

- Solar ordinances/laws can be incorporated into this plan to provide guidelines for solar projects moving forward

2. Subarea plans: provide a framework for redevelopment of a limited geographic area (neighborhood, special district, etc.). Include more specific goals than comprehensive plans in specific areas.

- Solar energy goals can be incorporated here at a more focused level

3. Functional plans: stand-alone plans that cover a specific topic. Can either be part of the comprehensive plan or on their own. Policies, goals, and implementation actions can be established in these.

- Solar development objectives can be incorporated here.

Utility scale solar projects are normally proposed like any other land-use permits. The projects must adhere to the guidelines of any local comprehensive plans and zoning ordinances that are in place (Coffey, 2019).

The final 'first' step for a solar project is to receive approval from the state. In Virginia, solar projects between 5 and 150 megawatts must obtain a PBR from the Virginia DEQ prior to installation. To obtain a PBR, project applicants must receive certification from the local government where the site will be located, conduct the necessary interconnection, environmental impact, and financial studies, as well as analyze and work to mitigate any potential adverse impacts from the project. Applicants must also hold public meetings and take public comments prior to construction (*Bill Tracking - 2009 Session > Legislation*, n.d.).

Once these 'first steps' are completed and the project as received final approval from the state, the last steps require the developer provide a 'Notice of Intent' and pay the necessary fees to receive a solar permit. Once this process is complete, the construction of the facility can begin and the monitoring process is set in motion. The facility will then remain in operation until its termination date.

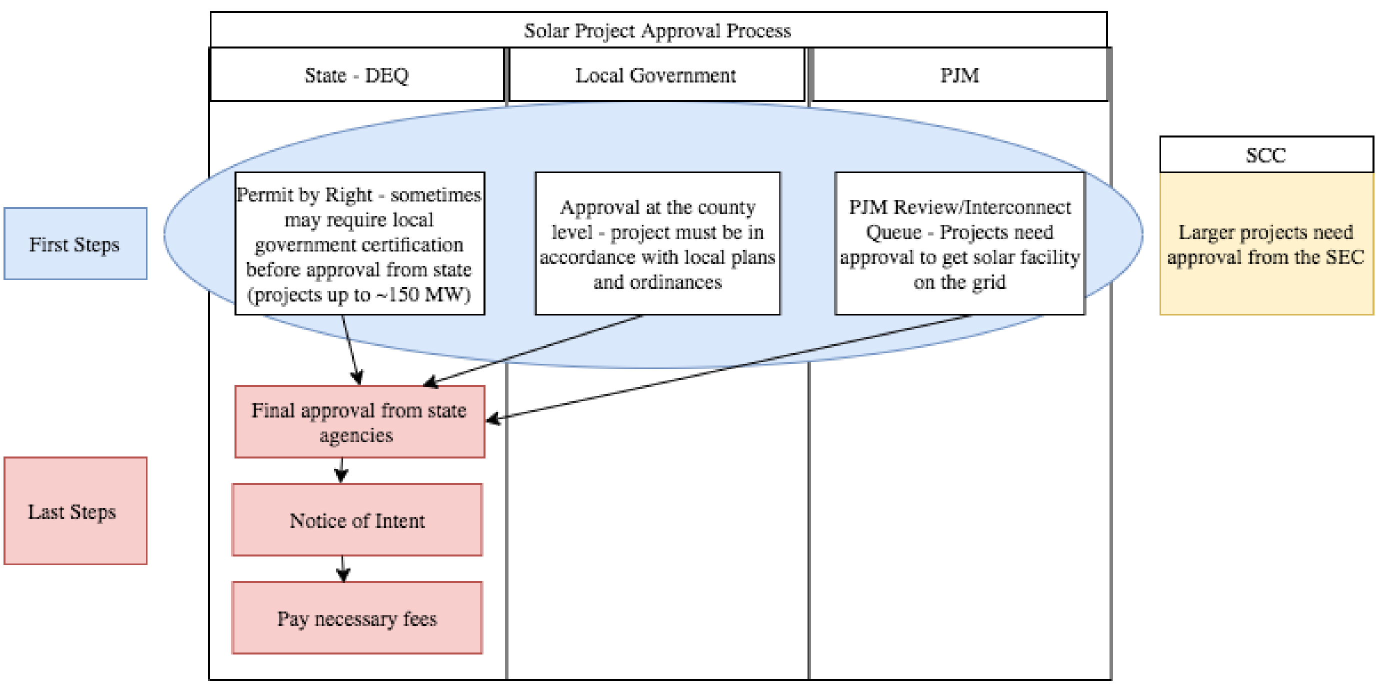


Figure 6 Diagram of the USS project approval process

Social Acceptance and Renewable Energy Projects

There are a multitude of technical barriers that can bar renewable energy projects from being installed. These can include issues with technology, cost, construction, and more. However, there is another set of obstacles that also impedes the implementation of renewable energy projects: non-technical barriers. These obstacles can include a lack of government policy supporting renewables, a lack of adequate codes, standards, and interconnection and net-metering guidelines, among others (Margolis & Zuboy, 2006). Arguably the most important non-technical barrier to renewable energy projects is the perception of the public on such projects. There has been research that has shown that social acceptance is just as important in determining the success of a renewable energy project as concerns with the technology or legislative framework (Jobert et al., 2007; Pasqualetti, 2011; Wüstenhagen et al., 2007).

The study of social acceptance of renewables has been a field that was largely ignored until recent years. Due to high perceived public support of renewable energy sources (garnered from public surveys), local officials were led to believe that social acceptance of renewable energy sources was a given (Wüstenhagen et al., 2007). However, this is certainly not the case and the perception of the different stakeholders at the local level plays a key role in the approval process of renewable projects.

The term "social acceptance" has been commonly used in this field of study, but there is still a lack of a clear definition. Wüstenhagen et al. (2007) created a theoretical model that included three major aspects of social acceptance for renewable projects. These aspects were socio-political, community, and market acceptance.

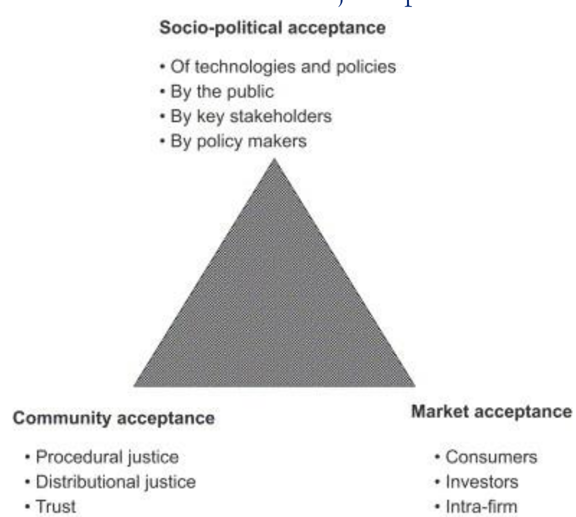


Figure 7 Three aspects of social acceptance. Source: (Wüstenhagen et al., 2007)

Socio-political Acceptance

Socio-political acceptance is the broadest, most general level of acceptance and refers to the perception of the key stakeholders (the policymakers) and their implementation of effective policies. How these stakeholders view renewables and how they implement policies around them functionally shape community and market acceptance (Wüstenhagen et al., 2007). High socio-political acceptance describes a policy landscape that is favorable to renewable projects and tends to have high general public support (Sposato & Hampl, 2018).

Community Acceptance

This aspect refers to the stakeholders at the local level, mainly residents and local authorities. It mostly highlights issues that surround the renewable energy project itself (Sposato & Hampl, 2018). High community acceptance occurs when residents and authorities feel there is a high level of distributional justice, procedural justice, and trust between them and the developer (Wüstenhagen et al., 2007). This section is also where the discussion of NIMBYism ("Not in My Backyard") occurs and how the term of "social acceptance" is used in this field. These terms are highly stigmatized and are highly present in current literature.

Market Acceptance
This aspect refers to the process of market adoption of different renewable energy innovations. The focus is on the degree of acceptance from both consumers and investors within the firms adopting the technology (Sposato & Hampl, 2018; Wüstenhagen et al., 2007). This is an area that is not as expanded upon and would benefit from further research.

These three aspects cover the general range of social acceptance for renewable energy projects. At the community level, it has been observed that social acceptance typically develops along with the renewable energy projects. The development follows a U-shape; the community members and officials have high acceptance before the onset of the process (this is reflected in the high popularity for renewable sources in public sources), acceptance becomes relatively lower when the project is introduced in their vicinity and they are faced with the planning and siting stage, and then returns to a higher level after the completion of the project (Wolsink, 2007). This U-shape was observed in a case study that took place in Australia by Guerin (2017). They found that the risks that were considered to be 'high' during the planning and siting process (noise and visual impact) actually turned out the be the lowest risk. They actually found that local residents wanted viewing platforms set up so they could observe the facility. This shows how the opposition that was present during the planning and siting stage largely went away after the project's completion.

Possible Solutions
When addressing the issue of social acceptance for renewable projects, the literature highlights some possible ways to address it. The most discussed solution is one that emphasizes the importance of maintaining procedural justice. A planning and siting process that emphasizes procedural justice is one with a high level of transparency, provides local residents with accurate information and does it early in the process, and creates opportunities for residents to participate (Batel et al., 2013; Wüstenhagen et al., 2007; Zoellner et al., 2008). Batel et al. (2013) further emphasizes that a successful process promotes and deploys a multilateral and participatory approach. Zoellner et al. (2008) go further and highlight the importance of developers actively demonstrating their commitment to the ideals and values of the community where they proposed their project. The developer needs to be conscious and actively responsive to the environmental, procedural, and risk perception issues that the local residents express.

The literature also focuses attention on the importance of spotlighting the benefits that the renewable energy projects can provide. Perceived economic benefits received from a project are one of the strongest predictors for acceptance (Zoellner et al., 2008). Additionally, providing information to residents on the regional benefits that renewable projects provides is also a strong predictor of acceptance (Cohen et al., 2015).

Overall, the literature emphasizes of involving the local residents and authorities in the planning and siting process as early as possible. The applicant should be transparent, provide accurate information as early as possible, and provide for multiple opportunities for community participation in the process. They should also focus on highlighting the benefits of the projects to improve the likelihood of acceptance.

Areas for Further Research

Most of the research on social acceptance of renewable energy projects is focused on wind energy projects. This is due to their large visual impacts and high amount of required land use. An area for further research that could be beneficial to this field is a comparative study of how utility-scale solar projects are similar and different from wind energy projects. This could help tailor the planning and siting processes for USS and wind projects.

Another common topic for social acceptance research is social opposition and 'social acceptance' in general. There are a number of studies about NIMBYism and 'social acceptance' that are focused on people that oppose renewable projects. However, since the important stakeholders are those that support these projects, there should be more research about those that do support these projects.

Problem Statement and Description

Problem Statement: To address the growing problems that result from climate change and to meet its new, ambitious renewable energy goals, Virginia needs to produce more electricity (in MW) from solar energy sources. However, technical, cultural, and procedural barriers prevent the approval of new utility-scale solar projects.

Energy Sources in Virginia

There is a trend of fossil fuel usage present in Virginia. In the past 75 years, Virginia's electricity generation has been dominated by carbon-emitting sources. The use of natural gas has been steadily increasing, surpassing all others as Virginia's dominant electricity generation source. As seen in Figure 8, natural gas surpassed coal around 2014 and nuclear around 2016. This is a relatively promising trend for Virginia, as natural gas emits around 50% less carbon than coal sources (*Frequently Asked Questions (FAQs) - U.S. Energy Information Administration (EIA)*, n.d.). However, while natural gas sources do emit less carbon than the traditional coal plants, they are still a 'dirty' source of energy.

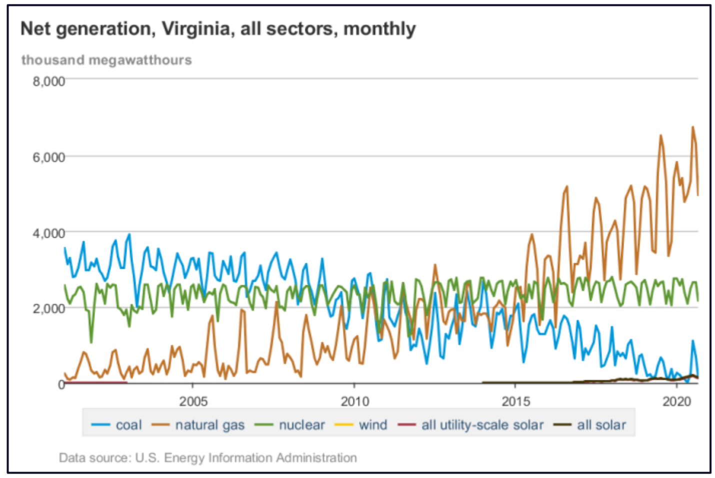


Figure 8 Net electricity generation by source in Virginia in the past 20 years. Source: (*Virginia - State Energy Profile Overview - U.S. Energy Information Administration (EIA)*, n.d.)

Renewable Energy Compared to other Energy Sources in Virginia

In the past 5 years, the net generation from solar sources in Virginia has increased. This trend is expected to continue to rise, with the passing of the Virginia Clean Economy Act (VCEA) that calls for a large increase in renewable energy sources. However, as seen in Figure 9, renewable energy sources still only represent a very small proportion of Virginia's net electricity generation. The increases in generation as a result of the VCEA and the projected growth are promising, but the amount of generation from renewables must increase at a higher rate if the effects from climate change are going to be addressed.

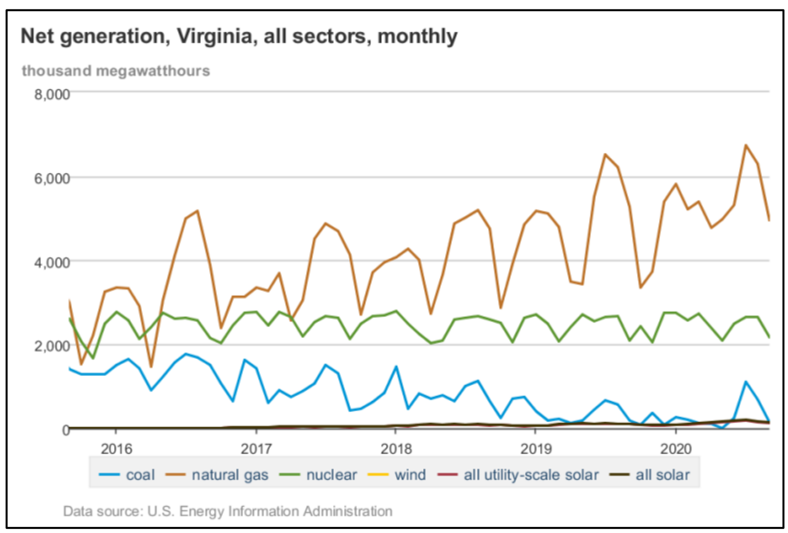


Figure 9 Net electricity generation in Virginia from all sectors since 2015. Source: (*Virginia - State Energy Profile Overview - U.S. Energy Information Administration (EIA)*, n.d.)

Factors Exacerbating the Problem

Solar energy is becoming more commonly used in both Virginia and the US. However, not every locality completely supports the installation of solar facilities. During most approval processes for USS facilities, there are community members that voice opposition against the project. Some common concerns that are raised by local residents include:

- Solar projects take up too much land that can be used for other purposes
- Tax revenues will be lost from other land uses, such as new residential developments or other industries
- Jobs that are created will only be temporary and may be outsourced to out of state contractors
- Solar facilities are subsidized
- Ecological and environmental effects of construction
- Landscape destruction
- A depressing effect of local businesses and residents that live near the rezoned land
- A solar project contradicts the "rural feel" of localities in Virginia
- Perceived visual impacts of project on residents that live in the vicinity

Additionally, due to the relative novelty of solar energy sources, many local governments are not equipped to permit and oversee development of solar facilities. They typically struggle with how to evaluate USS applications and with how to update their land-use regulations. Most of the time when approving solar projects, localities use their general tools which include existing comprehensive plans and zoning ordinances. However, most of these do not include guidelines on how to incorporate massive utility scale solar (*Planning for Utility-Scale Solar Energy Facilities*, n.d.). Additionally, the facilities will require massive amounts of local resources to monitor during the construction phase, which puts more strain on the local governments. Developers and local officials will have to work to address the concerns of the citizens because construction can have significant impacts on them depending on location, buffers, installation techniques, etc. Localities also need to balance the overall value that a solar facility will bring and must consider the impacts and benefits to the social fabric, natural environment, and local economy (*Planning for Utility-Scale Solar Energy Facilities*, n.d.).

Evaluative Criteria

The following criteria will be utilized to evaluate each proposed policy alternative: (1) effectiveness, (2) cost, (3) feasibility (both administrative and political), and (4) equity. Each criterion will be weighted equally.

Evaluative Criteria 1: Effectiveness

The effectiveness of an alternative is determined by the increase in the amount of MWs generated from solar projects as a result of the proposed alternative. The data to quantify the increase in MW generation each alternative would have was not available during this analysis. Therefore, an estimation of the likely effect each alternative would have is utilized. The estimations are based on current trends and practices, as well as existing literature.

Evaluative Criteria 2: Cost

The cost of each alternative is determined by the amount of staff time that is required, the monetary expenses that fall upon CHESSA to implement the alternative, and any additional monetary expenses that would result from implementation. The combination of these factors will be used to estimate the level of cost of each alternative.

Evaluative Criteria 3: Feasibility

The feasibility of each alternative will look at both administrative and political feasibility. Administrative feasibility will assess CHESSA's ability to implement the alternative given their current operational capacity. Political feasibility will assess CHESSA's ability to secure necessary funding for the alternative, their ability to establish a working relationship with Virginia state agencies, and the level of political acceptance or popularity each alternative would have.

Evaluative Criteria 4: Equity

CHESSA has affirmed they are committed to diversity, inclusion, and equity (*Commitment to Equity | MD DC DE VA Solar Energy Industries Association*, n.d.). This criterion will assess the level to which each alternative coincides with the ideals and goals that CHESSA has established for equity. It is important that each proposed alternative provides equal opportunity to all groups, especially to those that are underserved, underrepresented, and marginalized.

Policy Alternatives and Evaluation

In order to increase the amount of MW of solar energy being generated in Virginia, there are three factors that must be addressed:

1. Some local governments do not consider solar projects a good land use
2. Some local residents do not see greater benefit than cost of solar projects being built in their neighborhood
3. The ability of local governments to realize benefits from developing USS projects through Virginia legislation

The alternatives provided below will address one of these factors and will help CHESSA alleviate these barriers to the development of USS projects.

Alternative 1: Allow present trends to continue.

This alternative would require CHESSA to take no additional actions in helping local governments and solar developers with USS projects. CHESSA would continue to "deliver on policy formation, advocacy, market representation, networking, education, and additional benefits" for the members that they represent by focusing on other deliverables – such as regulatory engagement or legislative advocacy (*(16) Chesapeake Solar & Storage Association: About | LinkedIn*, n.d.). CHESSA will also continue to provide their members with the resources from the national SEIA organization; including educational content on trade, technology and the environment, financing and tax information, solar policy, and more (*Initiatives & Advocacy*, n.d.).

This alternative maintains that it is the primary role of the individual solar developers to determine how to increase social acceptance and address the claims that community members express against USS projects. Additionally, due to the nature of the PJM interconnect queue process, any additional policy options that CHESSA may take would be biased towards projects that are further back in the queue. To avoid prioritizing these projects over others, CHESSA would allow solar developers to address these issues independently. Therefore, allowing 'present trends to continue' could lead to these issues being resolved without intervention from CHESSA.

With CHESSA's current policy measures, the number of solar installations in Virginia have increased since 2013 and are projected to continue increase as well (*Virginia Solar*, n.d.). While their actions do not directly support individual projects, it has created a supportive policy environment enabling a greater number of projects. It is safe to assume that there will continue to be growth, especially with the passage of the VCEA. Further action from CHESSA on land use issues to increase the amount of MW's generated from solar may not be necessary.

However, one downside to this policy alternative is that implementing no further actions may not be enough to assist Virginia with its goals stated in the VCEA. Additional action may be required if Virginia wants to meet these ambitious goals, and CHESSA may need to play a direct role in helping the state get there.

Evaluation of Alternative 1

Effectiveness: Medium

This alternative would be **moderately effective** at increasing the amount of MWs generated from solar in Virginia. As seen in Figure 5, the amount of annual solar installations increased by over 1000% from 2019 to 2020 (*Virginia Solar*, n.d.). This increase in MW capacity in Virginia is largely due to the passing of the Virginia Clean Economy Act, HB 1675, and SB 762/HB 1131 which provided demand for solar energy and increased the benefits localities can receive from solar projects. The Virginia DEQ's permit by rule program saw applications grow from one in 2015 to over 70 in 2020 (Vogelsong et al., 2020).

The new statutes and current increase in solar installations does come with some potential risks. Rural counties in Virginia are still hesitant to adopt solar projects and a few have already rejected proposed solar projects. There are also a high amount of projects awaiting PJM review, as well as county and DEQ approvals (*Virginia Solar Projects-01272021-0001.Pdf*, n.d.). Even with the new statutes, a number of counties still do not feel they are being provided with enough benefits to make the solar projects equitable between developers and localities (Vogelsong et al., 2020). Additionally, it is relatively unprecedented for localities to have the authority to impose special exception conditions that require cash payments, dedication of land, or other contributions from solar developers. There is a lack of a set processes for localities and developers to move under this new legislation (Bryant et al., 2020). This will lead to a longer period of time before the necessary increases of solar installation are met to meet the ambitious goals of VCEA and could potentially put the state at risk of falling short of their goals.

Cost: Low

This alternative would incur **low costs** for CHESSA in terms of staff time, implementation costs, and monetary costs following implementation. Since this alternative does not require additional implementation from CHESSA, the amount of staff time put in would not change, there would be no implementation costs, and no additional costs as a result of implementation.

Feasibility: Medium

The **administrative feasibility** of this alternative would be **high**. Since no additional implementation is required, CHESSA can maintain their current operational capacity and continue with 'business as usual.'

The **political feasibility** of this alternative would be **low**. While there would be no need for CHESSA to secure additional funding and their working relationship with Virginia state agencies would not change, no additional action to increase solar generation would not be well accepted by Virginia's government and CHESSA's membership. The passing of the VCEA set very challenging goals for the amount of solar generation to be installed in Virginia. Therefore, Virginia's state government will expect CHESSA and other solar advocacy groups to undertake additional efforts to increase solar generation capacity.

Overall, this alternative would have **medium feasibility** due to its high administrative feasibility, but low political feasibility.

Equity: Medium

This alternative coincides with CHESSA's ideals and goals for **equity** to a **medium** level. While CHESSA would still uphold their commitment to equity, this alternative would not explicitly provide equal opportunity to communities that are underrepresented, underserved, or marginalized, as is stated in their equity statement. CHESSA would focus on other areas of policy that address social equity.

Alternative 2: Advocate for solar development that is more palatable for local residents.

This alternative would build upon the work that CHESSA does "deliver[ing] on policy formation, advocacy, market representation, networking, education, and more" (*MD DC DE VA Solar Energy Industries Association*, n.d.). **This alternative would build upon this work and expand their advocacy efforts to include solar development that is more agreeable to local residents.**

To expand these advocacy efforts, CHESSA would create a research team to collect information on different solar developments that would be more agreeable for local residents. After the initial research is complete, CHESSA would promote these development methods to solar developers. They would also be available as a resource moving forward if the developers had any questions about the technology.

This option would directly address the issue of social acceptance of USS projects at the local level. As mentioned in the problem definition and literature review sections, community members take issue with using land for solar projects, the viewshed that accompanies a large USS project, among other complaints. This alternative provides a solution for these issues by advocating for solar developments that would alleviate these complaints.

Examples of such development are building upon the boundary of the facility (i.e. by surrounding the solar farm with trees and creating a large enough buffer space so that the viewshed will not be impacted), pairing photovoltaic solar farms with agricultural land, or planting native grasses and wildflowers in place of turf or gravel. A more detailed section on solar development avenues that could be pursued is provided in Appendix B.

CHESSA could also help solar developers promote these more palatable solar developments to localities where they are seeking to install a project. This could include helping create newsletters with information about the development, creating a webinar that focuses on this technology, or holding a public forum where community members could discuss and ask questions about the project.

One obvious drawback to this alternative is that regardless of the amount of effort and advocacy put into making solar development more palatable, it is still up to the community members to accept the development of the project. To alleviate these concerns, community members should be involved often and early within the development process. Project development and investments can be tailored towards the needs of the community, and residents providing their input can help the development process go more smoothly (Batel et al., 2013; Friedl & Reichl, 2016; Wolsink, 2007).

This alternative will also significantly increase costs on current projects, assuming that developers were previously building facilities that were as cost efficient as possible in order to sell them to Dominion. Incorporating these aspects to increase palatability will likely increase the costs of these projects.

Evaluation of Alternative 2

Effectiveness: Low

This alternative would have **low effectiveness** at increasing the amount of MWs generated from solar in Virginia. While it would advocate for solar development that provides tangible benefits to developers and localities, it does not address the full range of community concerns facing solar projects. Some members have issue with how property values will be affected, or how the construction of the project will influence their day to day life. These issues will not be addressed through this alternative and as a result, there will still be local opposition to solar projects. Therefore, advocating for these solar developments could potentially lead to more adoption, but it is not likely.

Cost: Medium

This alternative would incur **medium costs** for CHESSA. In terms of staff time, CHESSA would be required to do additional work researching the solar development methods for developers. It would require current employees to spend additional time gathering resources and information. If the current employees cannot put in the additional time, CHESSA may be required to hire additional people to fill this workload, which would incur more costs onto them.

This alternative would impose minimal monetary costs upon CHESSA, but it would impose additional costs to developers. Instead of just laying down gravel or planting turf, developers would have to plant crops or native wildflowers or grasses. This would lead to them incur more costs during the construction phase. However, these costs would be offset by the benefits of reduced maintenance costs and the benefits of any crop yields. Overall, this alternative would lead to **medium costs** for developers.

Feasibility: High

The **administrative feasibility** of this alternative would be **high**. Advocating for new solar development methods is easily implemented by CHESSA. Therefore, pursuing this alternative would not put strain on their current operational capacity. Current employees would need to take up new research and information-gathering tasks, but it would be within their operational capacity to complete.

The **political feasibility** of this alternative would be **high**. CHESSA would not have to secure any state funding or work with any state agencies to implement this alternative. Additionally, this alternative would be popular with the Virginia state government. The solar developments that CHESSA would advocate for would improve solar cell efficiency and could likely increase social acceptance of solar projects. With Virginia's ambitious renewable energy goals that were laid out in the VCEA, this is an alternative that would have high political acceptance.

Equity: Low

This alternative coincides with CHESSA's ideals and goals for **equity** at a **low level**. The alternative is biased to solar projects that are in the pre-development phase and does not provide equal opportunity to underrepresented, underserved, and marginalized communities. While it does provide benefits to both developers and the surrounding community, there are still community members whose needs and concerns are not addressed.

Alternative 3: Create an educational series, hosted by DMME, that provides county-specific webinars on their current solar policies, how they can take advantage of siting agreements with solar developers, and how to utilize the new revenue share legislation. CHESSA would support the series and serve as a resource for answering questions.

The Virginia General Assembly passed two key pieces of legislation in the 2020 session that provide localities with more ways to realize benefits from solar development projects, HB 1675 and SB 762/HB 1131. These bills give localities more opportunities to gain financial compensation and mitigate impacts from USS projects. Another bill (HB 2201) was also passed recently that allowed siting agreements and zoning special exceptions to include energy storage projects. In addition, the bill added an index to the existing legislation on siting agreements (*LIS > Bill Tracking > HB2201 > 2021 Session*, n.d., p. 22). However, all these pieces of legislation were only passed recently, and many localities may not be aware of how this legislation could provide specific benefits to their county, nor know how to use them in a way that maximizes revenue without making the project economically infeasible. This is where CHESSA and DMME would step in.

CHESSA would work with DMME to create an educational series of county-specific webinars addressing the localities current solar polices; explain how county officials can utilize both the siting agreements, revenue share, and other mechanisms to maximize the benefits of solar development; and educate local residents on solar projects. To kickstart this process, CHESSA would approach DMME with this proposal and provide resources and case studies on localities that have already utilized either the revenue share or the siting agreements. A case study of siting agreements and community comments from three Virginia counties is provided in Appendix A for reference. With this baseline information, DMME would build upon these resources and CHESSA would provide support for the series while conducting additional research and information-gathering if needed. CHESSA would support the series and be available as a resource for answering questions about the legislation, and USS projects in general.

Once the initial information-gathering is completed, both CHESSA and DMME will launch a PR campaign promoting the educational series and attempting to incentivize localities to sign up for webinar sessions. The campaign will focus primarily on the benefits that revenue share and siting agreements can bring to localities. It would include mass emails to local officials, an announcement on DMME's social media pages, and the creation of a new webpage on DMME's website to house the sign-up system and information about the webinars for localities to access. The emails and social media posts should include a summary of the webinar, a quick highlight of the benefits the localities can receive, and a link to sign up for the webinars.

The educational series would be available to all localities in Virginia. Webinars would be scheduled in the order that each county signs up. Prior to a county's specific webinar, additional research will be needed on the current solar policies that the locality has in place and the creation of policy options for each locality will need. CHESSA would support DMME with this research and policy option creation to ensure they are not overwhelmed. CHESSA would also have a subject matter expert sit in on each of the webinars and be available to answer any questions that the localities may have. This position can be filled by an existing staff member or CHESSA may choose to onboard a new member to help with the educational series full-time.

The content of the webinar would be designed with two separate focuses: clearly explaining the details of the Siting Agreement and Revenue Share legislations to county officials and educating local residents on USS projects. For county officials, the webinar would expand upon the different opportunities localities have to gain from solar projects. It will also include examples of counties that have already entered into these agreements and what additional benefits and county needs they focused on. It is important that these webinars emphasize the economic benefits that local governments can get from these agreements and ordinances. The webinar will also explain how 'conditions' set by the locality (vegetative screening, fencing requirements, traffic mitigation, etc.) can negatively affect solar projects and raise costs for them. The webinar will inform counties on ways that they can maximize what they want from the projects without killing them all together. Additionally, developers active in the localities would be able to contact CHESSA staff and inform them of key points to highlight or prepare them for specific questions they may receive.

For community residents, the webinar would provide a general overview of the solar permitting process. It would address the common concerns that come up during this process (including, but not limited to viewshed, environmental/ecological concerns, property values, construction details) and explain how these issues can be addressed during the approval process and through the siting agreements. The webinar would also provide examples of instances where a USS project developer addressed these concerns through the project conditions in other counties. CHESSA and DMME would ask local developers who are interested in filing USS projects in the locality to sit on these webinars. The community members will have time to question these developers about their proposal and how the plan to address their concerns. The subject matter expert that CHESSA has will also be available to answer any questions about solar technology, the approval process, and any other topics.

The webinar should be accessible for all community members that want to attend. DMME, CHESSA, and the locality involved should encourage community member involvement in order to get them involved early on in the process. If any community member cannot get access to the webinar, CHESSA and DMME would work together to ensure that all residents can participate in the webinar. This could entail CHESSA and DMME coordinating with the locality to set up a Covid-safe viewing area of the webinar in a community building.

One potential barrier to this alternative would be running an effective PR campaign that maximizes county participation. The goal of the campaign would be to get as many localities as possible to sign-up for webinars, but participation is not guaranteed. To help alleviate this potential problem, the PR campaign should run constantly and follow-ups to specific counties that have opposed solar development in the past should be conducted. By highlighting all the benefits that localities can now realize from USS projects, it is more likely that counties will at least be willing to attend the webinar to gather information.

Evaluation of Alternative 3

Effectiveness: High

This alternative would be **highly effective** at increasing the amount of MWs generated from solar in Virginia. The goal of siting agreement and revenue share legislation passed by the Virginia General Assembly was to provide localities with more opportunities to benefit from solar projects. This alternative would connect Virginia local governments with these opportunities early in the development process. It will provide localities with a roadmap of how to navigate these agreements and ordinances in order to gain maximum benefits. If localities are gaining more benefits from proposed solar projects, they should be more likely to approve them.

Additionally, this alternative would get the community involved early in the process. According to a multitude of studies, getting the public more involved (and involved early) makes it more likely that the project will succeed (Batel et al., 2013; Friedl & Reichl, 2016; Wolsink, 2007). The educational series will also show local residents the benefits they will get from the solar project, assure them the locality can guarantee that the developer mitigate negative impacts of the project, and more. The webinar would ensure that the local officials and residents understand the benefits they could gain, which would make them far more likely to accept the proposed project.

Costs: Medium-High

This alternative would incur **medium to high costs** for CHESSA. It would require additional staff time researching and preparing the webinars for each locality. It would also require a CHESSA employee to sit in for each of the webinars and be available to answer any questions, which is an additional time cost. The alternative would also impose monetary expenses upon CHESSA. They would have to send emails promoting the educational series, contribute to any legal expenses for having experts attend the webinars, and pay to set-up and run each of the webinars. Depending on the number of localities that sign up for the webinars, these time and monetary costs could be either medium or high.

Feasibility: Medium-High

The **administrative feasibility** of this alternative would be **high**. It is well within CHESSA's current operating capacity to take on the work that this alternative would require, but it does require a lot of staff time. The alternative does fall within the work that CHESSA already prioritizes, so the work done by the staff would not be much different what they normally do.

The **political feasibility** of this alternative would be **moderate**. It would have a high level of political acceptance, because the state government would want to have a method to encourage localities to utilize the new legislative tools that they created. However, this alternative would require DMME to agree to co-fund the educational series. It is likely that they would approve of the project, but with DMME's limited budget they will have to make financial decisions. This alternative would also require a high amount of communication between CHESSA and DMME, which may be difficult to maintain.

Equity: High

This alternative coincides with CHESSA's ideals and goals for **equity** at a **high level.** It provides equal opportunity to all underrepresented, underserved, and marginalized communities because the educational series is available to all localities. Additionally, CHESSA and DMME will ensure that all community members that want to attend will be able. This alternative represents the interests of the solar developers, the local governments, as well as the community members, making it a highly equitable option.

Alternative 4: Create a resource bank for solar developers that pools together facts and trusted information on how to address and rebut common claims that community members make against USS projects.

When developers propose USS projects to a locality, it is very common to have community members raise concerns and claims against approving these projects. Solar developers are mostly aware of the common issues that residents have due to the high volume of projects that have been proposed in Virginia. However, there is no common resource that lists all of the comments that have been expressed and there is no centralized resource for rebutting these claims. CHESSA would provide this resource to solar developers.

This alternative would have CHESSA compile all the known community members concerns and claims against USS projects into one 'resource bank'. They would also provide facts and trusted information on how to best rebut these claims and guidelines on how to interact with community members. CHESSA would put together a team of researchers to create this 'resource bank'. Team members could be reallocated from within the existing CHESSA team, or can be hired from the outside. These team members would be responsible for researching and compiling common concerns and claims that residents raised against USS projects. For reference, the case study in Appendix A provides a list of comments in support and opposition of USS projects in three counties.

Once the information-gathering stage is completed, the team would be responsible for either creating a new website or a new webpage within CHESSA's website to hold this information. They would then be responsible for launching a PR campaign to raise awareness within the solar development field. The team would send out mass emails to solar developers and post on all social media platforms. The message will include a synthesis of what is contained within the resource bank and a link to the respective website or page.

This resource bank should also include a set of guidelines pertaining to how solar developers should interact with community members. It is important for solar developers to be transparent, open, and allow for community members to participate early and often in the planning and installation process (Batel et al., 2013; Friedl & Reichl, 2016; Zoellner et al., 2008). The guidelines would provide developers with instructions on how to set up community workshops, provide a clear path of communication between the developers and community members, and create a public forum for discussion.

One drawback for this alternative is that it may only be helpful to smaller solar developers. For the most part, large, national developers will know this information and have it 'in house'. Therefore, there could be a potential take-up issue with the smaller developers. They will have to decide whether or not they want to utilize this resource. The issue of buy-in could impede the effectiveness of this alternative if smaller developers decide not to use the information. Additionally, the use of these rebuttals against community member claims does not guarantee the dissenting party will change their mind. CHESSA should emphasize that developers should be proactive when using this resource and attempt to address community concerns before they arise. As mentioned earlier, involving community members early in the procedural process generally leads to less pushback from them (Friedl & Reichl, 2016).

Evaluation of Alternative 4

Effectiveness: Medium-Low
This alternative would have **medium to low effectiveness** at increasing the amount of MWs generated from solar in Virginia. Solar developers have had experience with the permitting process for years now and most are aware of the barriers that local opposition imposes upon solar projects. While this alternative would centralize the information, provide rebuttals to the claims, and establish guidelines for interaction between developers and community members, it does not directly change the attitude and beliefs of the community where the project is being proposed.

Most solar projects that are proposed in Virginia localities are met with some level of opposition. Having rebuttals and best practices to address this opposition will be helpful to developers, but only to a moderate extent. The success of the project will still depend upon how the developer interacts with the community, how responsive they are to comments and concerns, and the attitudes and beliefs of the local officials.

Cost: Medium-Low
This alternative would incur **medium to low costs** for CHESSA. It would require additional staff time to research and compile the common concerns against solar and pair them with the appropriate rebuttals. It would also require the CHESSA staff to create a new website or webpage on their current website, and promote it accordingly.

Feasibility: High
The **administrative feasibility** of this alternative would be **high**. At CHESSA's current operating capacity, they could incorporate this research and resource building into their workload. It would take away from CHESSA's other priorities and would require a large amount of staff time without guaranteed benefits, but is still within CHESSA's scope.

The **political feasibility** of this alternative would be **high**. It would not require CHESSA to secure additional funding or have a working relationship with any state agencies. This alternative would also likely only be moderately politically accepted. It is helping solar developers address local concerns about solar and could potentially help the state reach their ambitious renewable generation goals. With the moderate political popularity the alternative would have and the lack of requirements to acquire funding and state agency cooperation, it is likely to be highly politically feasible.

Equity: Low
This alternative coincides with CHESSA's ideals and goals for **equity** at a **low level.** The alternative does not provide equal opportunity for underrepresented, underserved, and marginalized communities. The alternative is biased towards solar developers and focuses on the issues they are facing. It does not accommodate the issues of the community members or local officials.

Outcomes Matrix

	Effectiveness	Cost	Feasibility	Equity
Alternative 1: Allow present trends to continue	**Medium**	**Low**	**Medium**	**Medium**
Alternative 2: Advocacy for palatable solar development	**Low**	**Medium**	**High**	**Low**
Alternative 3: Educational webinar series	**High**	**Medium-High**	**Medium-High**	**High**
Alternative 4: Resource bank for solar developers	**Medium-Low**	**Medium-Low**	**High**	**Low**

Recommendation

Alternative 3: Educational series, hosted by DMME, that provides county-specific webinars on their current solar policies, how they can take advantage of siting agreements with solar developers, and how to utilize the new revenue share legislation. CHESSA would support the series and serve as a resource for answering questions.

The recommended alternative for CHESSA to pursue is Alternative 3, working with DMME to create an educational series that provides county-specific webinars to localities and their residents. This alternative was chosen because it scored the highest for effectiveness and equity. These are two criteria that CHESSA emphasizes since they want to increase the amount of MWs generated from solar and want opportunities to be available to all communities.

There are tradeoffs that come with this alternative. In terms of staff time and monetary expenses, it will incur the highest costs on CHESSA of the four alternatives proposed. However, these costs will be shared between both CHESSA and DMME, making them less of an obstacle to success. Additionally, the benefits of connecting local governments and community members to the siting agreement and revenue share legislation will be worth the time and monetary expenses that will be imposed.

Another tradeoff is that this alternative did not have the highest overall level of feasibility. It was highly feasible for CHESSA to implement this alternative and moderately feasible for it to be politically accepted and supported. Since this alternative would be politically popular, the potential barriers of acquiring the necessary funding and communicating with state agencies can be overcome.

Overall, the high effectiveness and equity of this alternative, paired with the marginally higher costs and the moderate to high level of feasibility make this alternative the clear choice. The implementation strategy for the alternative and potential challenges that CHESSA could face are described below.

Implementation

To move forward with the implementation of this alternative, CHESSA would have to present DMME with a proposal and a plan for the educational series. Here, CHESSA should leverage any contacts that they have within DMME to get approval and funding. One of the biggest risks for the implementation of the alternative is DMME not approving the series. To reduce the likelihood of this happening, CHESSA should be adequately prepared before approaching them with this proposal. They should create an outline of what the webinars will look like; complete preliminary research and information-gathering to prime DMME for the work they would do together; propose a plan to set-up and rollout the webinars; and have developers, local governments, and even citizens who support solar to indicate their support of the educational series. By approaching DMME with these prerequisites and preliminary support from the involved stakeholders, it should lower the risk of DMME rejecting the idea.

Once DMME approves and decides to co-fund this alternative, the next step would be to complete the research and information-gathering of the general content of the webinars. This would include detailed and easy to understand explanations of HB 1675, SB 762/HB 1131, and HB 2201; examples of Siting Agreements that counties have already adopted (focusing on what economic/environmental benefits and county needs these agreements addressed); common conditions that localities set on solar projects and how they affect them; and ways localities can maximize what they want from these projects while not making them infeasible.

Once this general information is gathered and formatted for the webinars, the next step would be to advertise the educational series to counties. This could include (but is not limited to) posting on CHESSA and DMME's respective social media pages, creating a post on LinkedIn, sending out mass emails to counties, creating a newsletter for distribution, creating a banner on CHESSA or DMME's website, or communicating it to local solar advocates in communities and encouraging them to spread it via word of mouth (Livestorm, n.d.).

A potential issue of selecting this alternative could have is that local governments and community members could see this series as a 'top-down' method for the state government to try and sell solar to localities. Since the webinars would be housed in DMME, it does not have a 'grassroots' feel and could appear as an attempt for the state government to push solar onto localities in order to meet their renewable energy goals. By getting solar advocates located in the communities to spread the word or participate in the webinars, it could help them become more widely accepted and increase the sign-up rate. Another way to address this barrier would be to ask localities that have already entered siting agreements to participate in the webinars. Hearing about the benefits of siting agreements and revenue share ordinances from another local official could help dissuade the feeling that the webinars are trying to 'push' solar onto localities. Rather, it would show that the webinars are in place to help local governments and communities realize the economic and environmental benefits that can come from solar projects.

The advertisement campaign should be maintained as long as counties continue to enroll. Concurrent to the advertisement, a new website or webpage on an existing website should be created to house the sign-up portal for the webinars. A link to this page (or even embedding the sign-up portal itself) should be included in each promotion. This page should include a short description of what the webinar entails and have instructions on how the localities should sign up. When signing up, the counties should have the option to pick a time that works best for them. To ensure that CHESSA and DMME have adequate time to prepare, there should be a buffer period from the sign up time to when the webinar is presented (approximately two weeks or so).

Once the advertisement campaign and sign-up page are completed and underway, the next step would be to create a flexible template for the webinars. This template should include the general information that CHESSA and DMME have already acquired. There should also be space available to be filled with the chosen counties current solar policies (compared to other localities) and any potential community needs, mitigation practices, programs, or infrastructure benefits they could include in an agreement. This would also include comments from developers who are active in the area. An example of what the webinar could look like, some tips for webinar creation, and an example of a webinar webpage design is provided in Appendix C.

A potential obstacle to the implementation of this alternative would be low enrollment from localities. In order to minimize the risk of this occurring, CHESSA must ensure that a quality advertisement campaign is created and maintained. When advertising, it is important to emphasize the perceived economic and environmental benefits the localities would receive as a result of the siting agreements. CHESSA and DMME should provide a current list of participating localities to incentivize enrollment. If other counties see that their neighbors are signing up, they may be more likely to do so themselves. CHESSA and DMME should also include updates on statistics on counties that have entered (or will be entering) siting agreements since the onset of the educational series. These updates should highlight benefits that these counties receive (or will be receiving) and could even include quotes from relevant local officials.

References

(16) Chesapeake Solar & Storage Association: About | LinkedIn. (n.d.). Retrieved March 8, 2021, from https://www.linkedin.com/company/mdv-seia/about/

Barron-Gafford, G., Pavao-Zuckerman, M., Minor, R., Sutter, L., Barnett-Moreno, I., Blackett, D., Thompson, M., Dimond, K., Gerlak, A., Nabhan, G., & Macknick, J. (2019). Agrivoltaics provide mutual benefits across the food–energy–water nexus in drylands. *Nature Sustainability*, *2*. https://doi.org/10.1038/s41893-019-0364-5

Batel, S., Devine-Wright, P., & Tangeland, T. (2013). Social acceptance of low carbon energy and associated infrastructures: A critical discussion. *Energy Policy*, *58*, 1–5. https://doi.org/10.1016/j.enpol.2013.03.018

Benefits of Renewable Energy Use | Union of Concerned Scientists. (n.d.). Retrieved April 4, 2021, from https://www.ucsusa.org/resources/benefits-renewable-energy-use

Bill Tracking—2009 session > Legislation. (n.d.). Retrieved October 21, 2020, from https://lis.virginia.gov/cgi-bin/legp604.exe?091+ful+CHAP0808&091+ful+CHAP0808

Bryant, M. P., Cosby, L. A. N., & Keene, D. B. (2020, May 6). *Virginia's New Solar Project Development Laws Offer Opportunities and Potential Risks*. JD Supra. https://www.jdsupra.com/legalnews/virginia-s-new-solar-project-81158/

Caldeira, K., Jain, A. K., & Hoffert, M. I. (2003). Climate Sensitivity Uncertainty and the Need for Energy Without CO2 Emission. *Science*, *299*(5615), 2052–2054. https://doi.org/10.1126/science.1078938

Clean Energy, Green Jobs | Union of Concerned Scientists. (2009). https://www.ucsusa.org/resources/clean-energy-green-jobs

Coffey, D. (2019). *Planning for Utility-Scale Solar Energy Facilities*. American Planning Association. https://www.planning.org/pas/memo/2019/sept/

Cohen, J., Moeltner, K., Schmidthaler, M., & Johannes Reichl. (2015). An empirical analysis of local opposition to new transmission lines across the EU-27. *The Energy Journal*, *37*(3), 59–82.

Commitment to Equity | MD DC DE VA Solar Energy Industries Association. (n.d.). Retrieved March 21, 2021, from https://mdvseia.org/about/commitment-to-equity/

Devabhaktuni, V., Alam, M., Shekara Sreenadh Reddy Depuru, S., Green, R. C., Nims, D., & Near, C. (2013). Solar energy: Trends and enabling technologies. *Renewable and Sustainable Energy Reviews*, *19*, 555–564. https://doi.org/10.1016/j.rser.2012.11.024

DSIRE. (n.d.). Retrieved October 22, 2020, from https://programs.dsireusa.org/system/program?state=US

Frequently Asked Questions (FAQs)—U.S. Energy Information Administration (EIA). (n.d.). Retrieved December 2, 2020, from https://www.eia.gov/tools/faqs/faq.php

Friedl, C., & Reichl, J. (2016). Realizing energy infrastructure projects – A qualitative empirical analysis of local practices to address social acceptance. *Energy Policy*, *89*, 184–193. https://doi.org/10.1016/j.enpol.2015.11.027

Guerin, T. (2017). A case study identifying and mitigating the environmental and community impacts from construction of a utility-scale solar photovoltaic power plant in eastern Australia. *Solar Energy*, *146*, 94–104. https://doi.org/10.1016/j.solener.2017.02.020

Gul, M., Kotak, Y., & Muneer, T. (2016). Review on recent trend of solar photovoltaic technology. *Energy Exploration & Exploitation*, *34*(4), 485–526.

Hand, M. M., Baldwin, S., DeMeo, E., Reilly, J. M., Mai, T., Arent, D., Porro, G., Meshek, M., & Sandor, D. (2012). Renewable Electricity Futures Study. Volume 1: Exploration of High-Penetration Renewable Electricity Futures. *National Renewable Energy Laboratory*, *1*, 280.

How much of U.S. carbon dioxide emissions are associated with electricity generation? (2017). Energy Information Agency (EIA). https://www.eia.gov/tools/faqs/faq.php

Initiatives & Advocacy. (n.d.). SEIA. Retrieved March 8, 2021, from https://www.seia.org/initiatives-advocacy

Jobert, A., Laborgne, P., & Mimler, S. (2007). Local acceptance of wind energy: Factors of success identified in French and German case studies. *Energy Policy*, *35*(5), 2751–2760. https://doi.org/10.1016/j.enpol.2006.12.005

Kampa, M., & Castanas, E. (2008). Human health effects of air pollution. *Environmental Pollution*, *151*(2), 362–367. https://doi.org/10.1016/j.envpol.2007.06.012

Kannan, N., & Vakeesan, D. (2016). Solar energy for future world: - A review. *Renewable and Sustainable Energy Reviews*, *62*, 1092–1105. https://doi.org/10.1016/j.rser.2016.05.022

LIS > Bill Tracking > HB1526 > 2020 session. (n.d.). Retrieved October 21, 2020, from https://lis.virginia.gov/cgi-bin/legp604.exe?201+sum+HB1526

LIS > Bill Tracking > HB2201 > 2021 session. (n.d.). Retrieved April 7, 2021, from https://lis.virginia.gov/cgi-bin/legp604.exe?212+sum+HB2201

Livestorm. (n.d.). *Webinar Promotion—The Ultimate Webinar Marketing Guide | Livestorm* (https://livestorm.co/) [Text/html]. Livestorm. Retrieved March 31, 2021, from https://livestorm.co/webinar-promotion/

Local Solar Permitting. (n.d.). SEIA. Retrieved October 21, 2020, from https://www.seia.org/initiatives/local-solar-permitting

Long, N., & Steinberger, K. (2016, July 26). *Renewable Energy Is Key to Fighting Climate Change*. NRDC. https://www.nrdc.org/experts/noah-long/renewable-energy-key-fighting-climate-change

Malinowski, M., Leon, J., & Abu-Rub, H. (2017). Solar Photovoltaic and Thermal Energy Systems: Current Technology and Future Trends. *Proceedings of the IEEE*, *PP*, 1–15. https://doi.org/10.1109/JPROC.2017.2690343

Mangum, A. F., Zorn, D., & Arel, M. (2020). *THE ECONOMIC CONTRIBUTION OF UTILITY SCALE SOLAR DEVELOPMENT TO VIRGINIA* (p. 60). https://mdvseia.org/wp-content/uploads/2020/06/MDVSEIA-Report-.pdf

Margolis, R., & Zuboy, J. (2006). *Nontechnical Barriers to Solar Energy Use: Review of Recent Literature* (NREL/TP-520-40116). National Renewable Energy Lab. (NREL), Golden, CO (United States). https://doi.org/10.2172/893639

Maryland Solar. (n.d.). SEIA. Retrieved October 26, 2020, from https://www.seia.org/state-solar-policy/maryland-solar

MD DC DE VA Solar Energy Industries Association. (n.d.). Retrieved March 30, 2021, from https://mdvseia.org/

NASA - The Ups and Downs of Global Warming. (n.d.). [Feature]. Brian Dunbar. Retrieved December 1, 2020, from https://www.nasa.gov/topics/earth/features/upsDownsGlobalWarming.html

Net Metering | Virginia | Dominion Energy. (n.d.). Retrieved December 4, 2020, from https://www.dominionenergy.com/virginia/renewable-energy-programs/net-metering

North Carolina Solar. (n.d.). SEIA. Retrieved October 26, 2020, from https://www.seia.org/state-solar-policy/north-carolina-solar

Nowak, B., Riley, R., & Cushing, P. (n.d.). *Virginia General Assembly Passes the Virginia Clean Economy Act (VCEA) and Several Other Important.*. Williams Mullen. Retrieved April 6, 2021, from https://www.williamsmullen.com/news/virginia-general-assembly-passes-virginia-clean-economy-act-vcea-and-several-other-important

Pasqualetti, M. J. (2011). Social Barriers to Renewable Energy Landscapes*. *Geographical Review*, *101*(2), 201–223. https://doi.org/10.1111/j.1931-0846.2011.00087.x

Planning for Utility-Scale Solar Energy Facilities. (n.d.). American Planning Association. Retrieved September 24, 2020, from https://www.planning.org/pas/memo/2019/sept/

PURPA 101. (n.d.). SEIA. Retrieved April 6, 2021, from https://www.seia.org/research-resources/purpa-101

PURPA Tracker. (n.d.). NARUC. Retrieved April 6, 2021, from https://www.naruc.org/nrri/nrri-activities/purpa-tracker/

Ray, D. (2017). *Lazard's Levelized Cost of Energy Analysis—Version 11.0*. 22.

Shubbak, M. H. (2019). Advances in solar photovoltaics: Technology review and patent trends. *Renewable and Sustainable Energy Reviews*, *115*, 109383. https://doi.org/10.1016/j.rser.2019.109383

Siegner, K., Wentzell, S., Urrutia, M., Mann, W., & Kennan, H. (n.d.). *A Cost-Benefit Analysis of Pollinator-Friendly Solar in Minnesota*. 25.

Solar Industry Research Data. (n.d.). SEIA. Retrieved September 24, 2020, from https://www.seia.org/solar-industry-research-data

Solar Investment Tax Credit (ITC). (n.d.). SEIA. Retrieved October 22, 2020, from https://www.seia.org/initiatives/solar-investment-tax-credit-itc

Solar Permitting And Inspections: An Overview | EnergySage. (2019, January 14). *Solar News*. https://news.energysage.com/solar-permitting-inspections-an-overview/

Sposato, R. G., & Hampl, N. (2018). Worldviews as predictors of wind and solar energy support in Austria: Bridging social acceptance and risk perception research. *Energy Research & Social Science*, *42*, 237–246. https://doi.org/10.1016/j.erss.2018.03.012

US EPA, O. (2016, April 24). *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015* [Reports and Assessments]. US EPA. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2015

US EPA, O. (2017, July 5). *State Renewable Energy Resources* [Overviews and Factsheets]. US EPA. https://www.epa.gov/statelocalenergy/state-renewable-energy-resources

Virginia | Midmarket Solar Policies in the United States | Solar Research | NREL. (n.d.). Retrieved October 26, 2020, from https://www.nrel.gov/solar/rps/va.html

Virginia Solar. (n.d.). SEIA. Retrieved October 26, 2020, from https://www.seia.org/state-solar-policy/virginia-solar

Virginia Solar Projects-01272021-0001.pdf. (n.d.). Retrieved March 29, 2021, from https://img1.wsimg.com/blobby/go/88b93667-7b19-4c27-a0d0-db782256409e/Virginia%20Solar%20Projects-01272021-0001.pdf

Vogelsong, S., December 1, V. M., & 2020. (2020, December 1). As solar farms multiply across Virginia, officials reckon with land use challenges. *Virginia Mercury*. https://www.virginiamercury.com/2020/12/01/as-solar-farms-multiply-across-virginia-officials-reckon-with-land-use-challenges/

Wolsink, M. (2007). Planning of renewables schemes: Deliberative and fair decision-making on landscape issues instead of reproachful accusations of non-cooperation. *Energy Policy*, *35*(5), 2692–2704. https://doi.org/10.1016/j.enpol.2006.12.002

Wuebbles, D. J., & Jain, A. K. (2001). Concerns about climate change and the role of fossil fuel use. *Fuel Processing Technology*, *71*(1), 99–119. https://doi.org/10.1016/S0378-3820(01)00139-4

Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007). Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy*, *35*(5), 2683–2691. https://doi.org/10.1016/j.enpol.2006.12.001

Zoellner, J., Schweizer-Ries, P., & Wemheuer, C. (2008). Public acceptance of renewable energies: Results from case studies in Germany. *Energy Policy*, *36*(11), 4136–4141. https://doi.org/10.1016/j.enpol.2008.06.026

Appendix A

Case Study of Three Solar Projects

In this short case study, I will be looking at project details of the solar project, the siting agreements that have been negotiated between the local government and the solar developer, and community input in three Virginia counties (King and Queen County, Charlotte County, and Sussex County). This case study will provide a brief overview of the proposed USS project, the major details of the siting agreements, community comments in opposition and support, a discussion of the similarities and differences between the siting agreements, and suggestions for areas of future research.

Two pieces of legislation (SB 762/HB 1131 and HB 1675) passed in the 2020 Virginia General Assembly allowed localities to negotiate siting agreements and revenue share plans. These bills are still in their infancy, therefore it is important to begin to determine what details and benefits localities tend to negotiate for with developers. This information can help inform future localities that are looking to enter into agreements with solar developers on the benefits that their neighbors are negotiating for.

County: King and Queen County

Project Name: Walnut Solar I, LLC

Developer: Open Road Renewables

MW Capacity: 150 MW

Acreage: 1,700 acres

Siting Agreement Details:

- <u>Voluntary payments</u>: payments of $1.33 million annually, over the first 3 years for a total of $4 million
    - This money will be used to support the already approved broadband program
- <u>Additional annual payments</u>: payments increase during project lifetime
    - $50,000 → years 1-5
    - $75,000 → years 6-10
    - $85,000 → years 11-20
    - $100,000 → years 21-40
    - Total of $3.475 million
- A <u>series of water tanks</u> supported by appropriate wells to assist volunteers and county paid staff in fire suppression
- Subject to annual real estate and machinery and tool taxes
    - Recognized that the locality could enter into a revenue sharing agreement with the developer <u>up until the final site plan approval</u>

- Decommissioning plan: a third party will set the terms for the plan and the amounts for the surety bond
    - Surety bond will be in the form of cash or an irrevocable letter of credit
    - The county has no legal obligation to set decommissioning plan

Community Comments:

- In support:
- The project will provide clean energy
- The Board, developer, and Planning Commission have listened to and addressed the community concerns and have done a good job
- The project will provide stability to the grid
- Revenues from the project will help move the broadband program
- In opposition:
- Viewshed
- Rural community feel
- Ecological/environmental effects
- Don't want a repeat of Essex County (polluted runoff from construction area)
- Effects on property values
- Effects on crop in adjacent fields
- Noise during construction
- Traffic congestion due to construction
- Those benefitting from project do not live in area of construction

Sources:

http://www.kingandqueenco.net/html/Govt/boarddocs/Minutes/2020/October%2026,%202020%20Board%20of%20Supervisors%20Minutes%20(work%20session).pdf

https://walnut-solar-project.s3.amazonaws.com/Walnut+Solar_download.pdf

https://img1.wsimg.com/blobby/go/88b93667-7b19-4c27-a0d0-db782256409e/Virginia%20Solar%20Projects-01272021-0001.pdf

County: Charlotte County

Project Name: Courthouse Solar, LLC

Developer: Novi Energy

MW Capacity: 167 MW

Acreage: ~1,354 acres

Siting Agreement Details:

Project Features, Conditions, and Mitigations

- Applicant is subject to all terms and conditions in the CUP application
- Applicant will conduct an annual valuation of taxable equipment
    - Will also provide an independent analysis and evaluation to affirm the total MW generation capacity of the facility can be attained through the equipment listed
- Applicant will provide a decommissioning plan and periodic adjustments of surety bond
- Applicant provides a deed conveying right of entry for enforcement and decommissioning

Revenue Structure

- Applicant must give a payment of $1 million to the County
    - Due within 45 days of start of commercial production
    - Separate and distinct from the revenue share agreement

- Agreement of revenue share: applicant pays annual supplemental payments of $1,400 per MW generated
    - Increases at a rate of 1.75% per annum (compounded annually)
- Statutory Structure of Payment; Statement of Benefit: both parties agree that this agreement is fair and mutually beneficial to both
    - Applicant is bound by law to make Payment in accordance to this Agreement
- Economic Incentive Grant: parties acknowledge that the revenue share agreement can be rescinded in the future. If this does occur, the following will take place…
    - Applicant would be required to pay M&T taxes, the amount paid in taxes would be returned to the applicant as an economic incentive grant
    - Applicant would still be contractually bound to pay $1,400/MW per year, with compounding interest, if RS ordinance is repealed

Miscellaneous Terms

- *These terms are largely consistent across the siting agreements looked at in this case study. To avoid repetition, the miscellaneous terms of the siting agreements will only be included in this section.*

- Parties agree that the Agreement shall begin on the 'Effective Date' and will last until the 'Termination Date.'
    - After the 'Termination Date', the Applicant has no obligation to make payments

- Mutual Covenants: the Applicant covenants to the County they will make the payments and will not seek to invalidate the agreement
- No Obligation to Develop: the Applicant has no obligation to develop or make payments until after the Commercial Operation Commencement Data of the Project
- Successors and Assigns: any successors or assigns by applicant will still be bound by this agreement
- Memorandum of Agreement: a memo of the project will be available in the land records in the 'Clerk's Office'
    - Recordation is at the expense of the Applicant
- Notices: notices will be sent to addresses listed in the Agreement
- Governing Law; Jurisdiction; Venue: this Agreement must be in accordance with the laws of the Commonwealth of Virginia
- Confidentiality: the Agreement is a public document, protected under the Freedom of Information Act (FOIA)
    - Information deemed 'Confidential' by Applicant does not need to be shared with public
- *(Unique to this Siting Agreement)* Subject-to-Appropriations: all payments and performances by the County are subject to the Boards approval and annual appropriations
- Severability; Invalidity Cause: any provision in the Agreement that conflicts with applicable law becomes void
    - Remaining provisions remain enforceable
    - If Agreement becomes invalid, there will be efforts to amend and reauthorize the Agreement
- Entire Agreement: this Agreement supersedes all prior agreements and schedules
    - Nothing in the Agreement can be amended without all parties present
- Construction: the Agreement was drafted with input from all parties
- Force Majeure: neither party is liable for any failure that is caused by a list of extraneous circumstances (for full list, check sources for full Siting Agreement)
- Third-Party Beneficiaries: no other party besides those involved will benefit from this Agreement
- Counterparts; Electronic Signatures: allows for copies of Agreement, all copies are the same agreement
    - Includes signatures of all parties

Community Comments:

- In support:
- Revenues gained from the project will benefit the county
- Project provides clean energy and a revenue source for farmers
- Project provides an opportunity for community expansion
- Project will provide local job opportunities
- In opposition
- Provided a list of concerns
    - Effects on wildlife and natural resources
    - Buffers
    - Traffic issues

    - Road that 'was' going to be used for entrance → this was changed to address this concern
    - Environmental and wetland concerns
    - Viewshed
    - Neighboring land values, property taxes
    - Area for construction
- Suggestion:
- Make the project smaller and plant native wildflowers to prevent excessive herbicide use and to benefit local wildlife

Sources:

https://www.novienergy.com/project/courthouse-solar-pv-development/

https://www.charlotteva.com/pdfs/packets/2021_02BOSPacket.pdf (pgs. 18-26)

https://www.charlotteva.com/pdfs/minutes/2020_12min.pdf

https://www.charlotteva.com/pdfs/minutes/2021_01_11min.pdf

County: Sussex County

Project Name: Cabin Point Solar Center, LLC

Developer: Orsted US

MW Capacity: 75 MW

Acreage: 1,468 acres
- Facility will only occupy ~506 acres

Siting Agreement Details:
Project Features, Conditions, and Mitigations
- Applicant is subject to all terms and conditions in the CUP application
- Applicant must provide County with current copies of all real property lease agreements
  - At minimum, must provide the annual lease payment amounts for each parcel being leased
- Applicant will conduct an annual valuation of taxable equipment
  - Will also provide an independent analysis and evaluation to affirm the total MW generation capacity of the facility can be attained through the equipment listed
- Applicant will provide a decommissioning plan and periodic adjustments of surety bond
- Applicant provides a deed conveying right of entry for enforcement and decommissioning
- Battery Storage: the Applicant is proposing the construction of multiple battery storage units
  - Applicant is responsible for training first responders on how to respond to an on-site emergency and must create an emergency action plan
- Broadband: acknowledges that the County's citizens and businesses are underserved by accessible and affordable broadband
  - The Applicant agrees to make financial payments [under the 'Payment Structure' portion of the Agreement] to support broadband development in the County

Payment Structures
- Capital Payments: the Applicant agrees to make payments to the County in accordance to Schedule A (depicted below) conditioned upon the beginning of commercial operation

Schedule A

Sussex County
Cabin Point Solar Center

8/19/2020

County Revenue over the 45 year lifespan = $9,997,115

CapEx Breakout	USD
Battery Modules and Containers	13,360,000
Power Conversion System	2,360,000
Energy Management System	1,291,000
Balance of System	4,034,000
Engineering and Construction	4,666,000
Battery Subtotal	25,711,000
Solar Panels	32,160,000
Inverters	4,765,000
Racking/Trackers	14,663,000
Engineering and Construction	37,397,000
Grid Attachment Facilities	1,550,000
Solar PV Subtotal	90,535,000
Grand Total	116,246,000

M&T Tax and Real Property Tax are based on CapEx value.

Real Property	
45 Yr Total	$2,109,907
Aeessed Value / Acre	$10,000
Project Size (acres)	506
Annual Appreciation	2%
Millage	0.580

M&T	
45 Yr Total	$3,445,475
Appraised Value	$116,246,000
M&T Exemption Yr 1-5	80%
M&T Exemption Yr 6-10	70%
M&T Exemption Yr 11+	60%
Utility Assessment Ratio	94%
Yr 1 Assessed Value	109,387,486
Millage	0.580

CUP Payment	
45 Yr Total	$250,000

Siting Agreement	
45 Yr Total	$4,191,733

Year	Real Property	M&T Depreciation	M&T	CUP Payment	Siting Agreement
1	29,348	90	114,201	250,000	100,000
2	29,935	90	114,201	0	100,000
3	30,534	90	114,201	0	100,000
4	31,144	90	114,201	0	60,000
5	31,767	89.73	113,858	0	61,200
6	32,403	87.29	166,143	0	62,424
7	33,051	84.7	161,213	0	63,672
8	33,712	81.96	155,998	0	64,946
9	34,386	79.06	150,478	0	66,245
10	35,074	75.98	144,616	0	67,570
11	35,775	72.71	184,523	0	68,921
12	36,491	69.25	175,742	0	70,300
13	37,220	65.58	166,428	0	71,706
14	37,965	61.7	156,582	0	73,140
15	38,724	57.58	146,126	0	74,602
16	39,499	53.21	135,036	0	76,095
17	40,289	48.58	123,286	0	77,616
18	41,094	43.67	110,825	0	79,169
19	41,916	38.47	97,629	0	80,752
20	42,754	32.95	83,620	0	82,367
21	43,610	27.11	68,799	0	84,014
22	44,482	20.91	53,065	0	85,695
23	45,371	14.34	36,392	0	87,409
24	46,279	10	25,378	0	89,157
25	47,204	10	25,378	0	90,940
26	48,149	10	25,378	0	92,759
27	49,111	10	25,378	0	94,614
28	50,094	10	25,378	0	96,506
29	51,096	10	25,378	0	98,436
30	52,117	10	25,378	0	100,405
31	53,160	10	25,378	0	102,413
32	54,223	10	25,378	0	104,461
33	55,307	10	25,378	0	106,551
34	56,414	10	25,378	0	108,682
35	57,542	10	25,378	0	110,855
36	58,693	10	25,378	0	113,072
37	59,867	10	25,378	0	115,334
38	61,064	10	25,378	0	117,641
39	62,285	10	25,378	0	119,993
40	63,531	10	25,378	0	122,393
41	64,802	10	25,378	0	124,841
42	66,098	10	25,378	0	127,338
43	67,420	10	25,378	0	129,885
44	68,768	10	25,378	0	132,482
45	70,143	10	25,378	0	135,132

  - Payment will be made to the County in any year in one lump sum payment
  - This payment is separate from any adopted revenue share ordinance, machinery and tools tax, and real estate taxes
- Statutory Structure of Payment; Statement of Benefit: both parties agree that this agreement is fair and mutually beneficial to both
  - Applicant is bound by law to make Payment in accordance to this Agreement
- Use of Payments by the County: the county plans to apply the Payments to:
  - Critical infrastructure projects to improve citizen quality of life
  - Fund capital improvement program
  - Meet needs of the current fiscal budget
  - Supplement or establish any fund for which the county maintains a balance policy
  - Support broadband funding

Miscellaneous Terms

- Same as Charlotte County, see section above

Community Comments:

- In support:
- Will provide revenue to county
- In opposition:
- Setbacks
- Buffers
- Height of the tools
- Forest resources and site restoration → propose to minimize clearing to areas impacted by project
- Wildlife corridors
- Grading plan → review plans by 3rd party
- Battery storage
- Decommissioning plan

Sources:

https://www.sussexcountyva.gov/uploads/docs/12%2017%202020%20Board%20Packet.pdf

https://www.sussexcountyva.gov/uploads/docs/Public%20Hearing%20Packet%209%2017%202020.pdf

Similarities and Differences of Siting Agreements

Similarities

- Requires that the developer follows all of the necessary conditions and terms in the CUP application
- Requires that the developer provides a plan for decommissioning the facility at the end of its lifetime
- Two of the three counties in this case study requires that the developer makes voluntary payments to the county <u>outside of an established revenue share ordinance or machinery and tool tax</u>
  - The county may use these payments to fund other programs and county needs
- Establishes that the developer must pay either the set machinery and tools tax or enter a revenue share agreement with the county

Differences

- King and Queen County included that the solar developer would provide the county with water tanks to aid the local first responders
- Sussex County included an item about battery storage requirements
  - The developer is responsible for teaching first responders how to respond to incidents that may occur to the battery storage units (i.e. fire response)
- Charlotte County included the "Economic Incentive Grant"

Areas for Future Research

As the use of siting agreements evolve in counties in Virginia, it will be important to determine what additional benefits these localities realize. Further research should be done on how voluntary payments aid counties with other programs and efforts for county betterment. There should also be research done on the impacts of the new revenue share ordinances as localities begin to adopt them. The revenues gained from these ordinances should be compared to what localities got under the machinery and tool taxes.

Appendix B

Figure 1 Agrivolatics in Piolenc. Source: https://www.pv-magazine.com/2020/03/31/a-good-year-for-solar-agrivoltaics-in-vineyards/

Technology: Agrivoltaics

Highlights:

Improved renewable energy production
Agriculture beneath solar panels leads to cooler temperatures

- PV efficiency decreases at a rate of about 0.5% per 10 degree Celsius increase (Adeh et al., 2019)
- Pairing PV cells with agriculture can cool temperatures by around 9 degrees Celsius during the day (Barron-Gafford et al., 2019)

Better water retention
Crops when paired with PV cells are able to retain water better

- Due to cooler temperatures during the day and warmer temperatures at night, crops were able to retain more moisture
- Irrigating only every two days, soil moistures were 13% higher
- Irrigating every day, soil moistures were 5% higher before the next watering

(Barron-Gafford et al., 2019)

Increased food production and water-use efficiency
Certain crops were able to produce more food and use water more efficiently when paired with PV panels

- Total food production for chiltepin fruit was 3x greater
- Water-use efficiency for jalapenos was 157% greater
- Water-use efficiency for cherry tomatos was 65% greater and the total fruit production doubled

(Barron-Gafford et al., 2019)

Sources:

Adeh, E. H., Good, S. P., Calaf, M., & Higgins, C. W. (2019). Solar PV Power Potential is Greatest Over Croplands. *Scientific Reports*, *9*(1), 11442. https://doi.org/10.1038/s41598-019-47803-3

Barron-Gafford, G., Pavao-Zuckerman, M., Minor, R., Sutter, L., Barnett-Moreno, I., Blackett, D., Thompson, M., Dimond, K., Gerlak, A., Nabhan, G., & Macknick, J. (2019). Agrivoltaics provide mutual benefits across the food–energy–water nexus in drylands. *Nature Sustainability*, *2*. https://doi.org/10.1038/s41893-019-0364-5

Technology: Pollinator-friendly solar development

Highlights:

- Provides a habitat for pollinators

- Preserves biodiversity
  - Provides habitats for threatened species (i.e. honeybees)

- Plants that root deep in area provide a multitude of benefits
  - Improve soil quality
  - Improve carbon sequestration
  - Decreases soil erosion
  - Increases groundwater retention
  - Decreases runoff

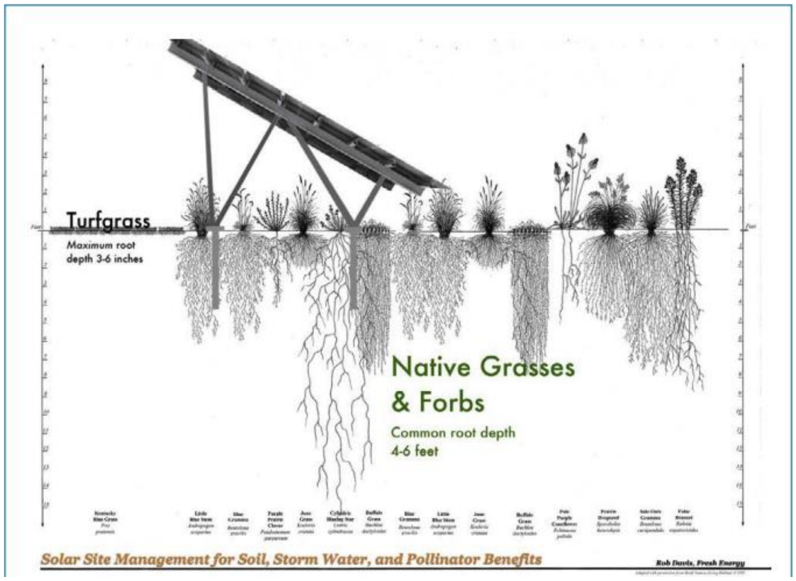


Figure 2 Pollinator-friendly solar development. Source: (Siegner et al., n.d.)

- Increases crop yields from pollinator-friendly projects that are co-located with farmland
  - Soy, cotton, and beans would benefit some from this co-location
  - Specialty crops like almonds, cranberries, apples and melons would greatly benefit from this co-location
  - Would not be helpful for farmland with non-pollinator-dependent crops (i.e. corn)

- Can improve renewable energy production
  - Plants under the PV panels can cool temperatures, which increases the efficiency of the panels

- Reduces maintenance costs and improves aesthetics

- Increases in net social benefits per acre over conventional projects
  - Conventional solar, net social benefit per acre: $14,651
  - Pollinator-friendly solar adjacent to soy farmland, net social benefit per acre: $22,597

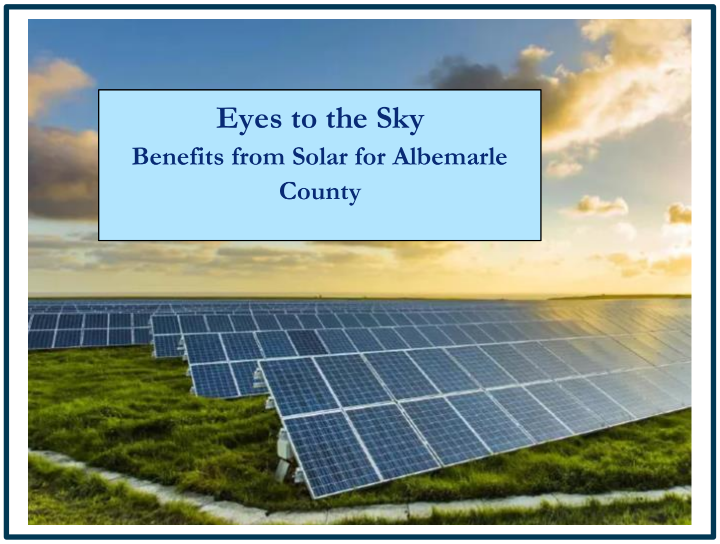
(Siegner et al., n.d.)

Sources:

Siegner, K., Wentzell, S., Urrutia, M., Mann, W., & Kennan, H. (n.d.). *A Cost-Benefit Analysis of Pollinator- Friendly Solar in Minnesota*. 25.

Appendix C

Introductory Slide



Body Slide #1

Virginia Solar Legislation

HB 1131	HB 1675	HB 2201
Main points of each statute, in bullet points	Main points of each statute, in bullet points	Main points of each statute, in bullet points

Body Slide #2

Community workshops
- Developers will be available to meet with residents
- Residents can raise concerns over projects
- Developers can discuss solutions

Public Comments
- Developers will present on their progress
- Residents will be able to come to planning commissions and board meetings to voice concerns

Board of Supervisors vote

Conclusion

Action Plan
- Determine details of USS project
- Determine if land is suitable
- Allow for Public Involvement
- Negotiate Siting Agreement

Tips for Designing Webinar Slides

- Keep slides simple, steps or a set number of information can be broken into multiple slides
- Visually arrange bullet points so they are easier to understand and see
  - Can use Smart Art in PowerPoint
- Add small graphics to slides, they should be meaningful images and not take up too much space
- Don't have graphics in the background of your content slides, it will distract from the points being made
- Do not use a lot of funky animations for content
  - Can use animations to "build" slides, adding pieces of information at a time (i.e. revealing steps in a process)
- Don't have transitions between slides
- Make sure the images included are small enough to not distract from the main content
- Use line drawings over images
- Eliminate wasteful writing, lines, images, shadows, reflections, etc., they are not needed

The Content

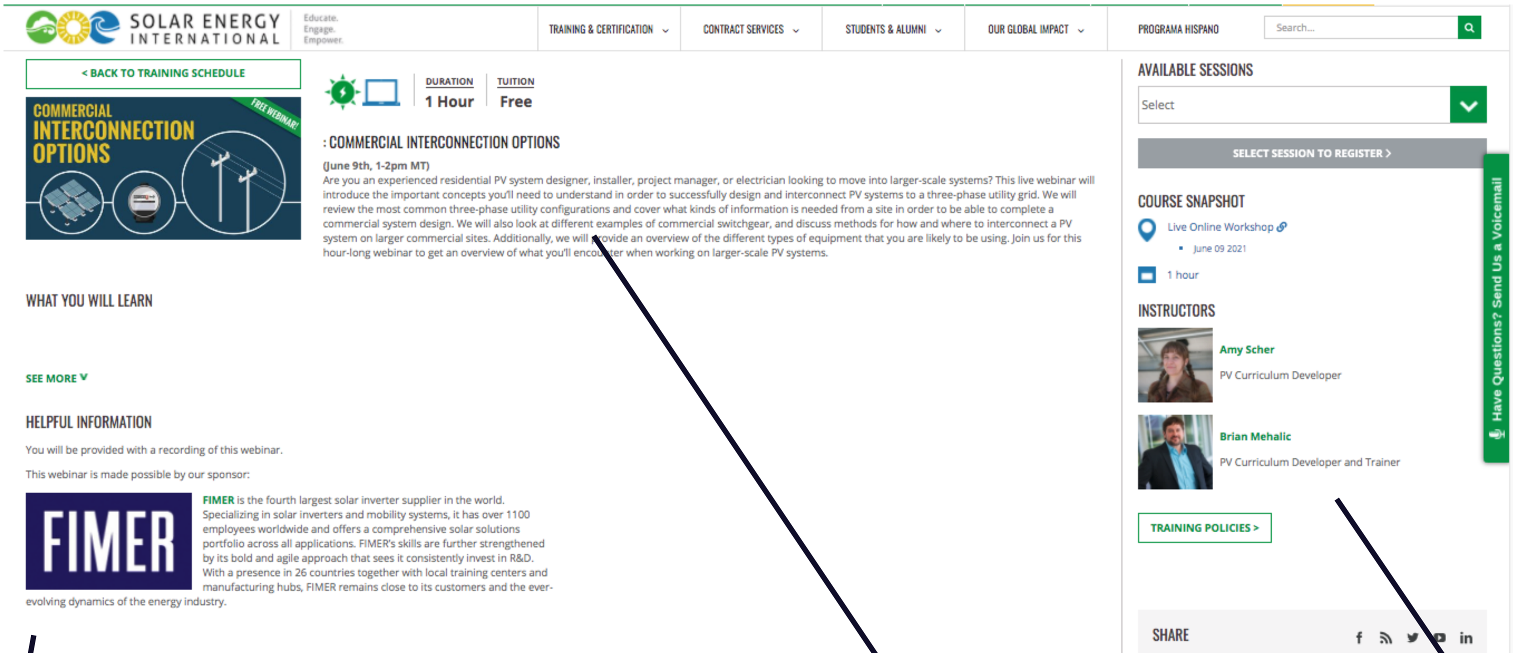
- Begin with an introduction of the presenter and the topic
  - Have an overview of the presentation, prime the audience
- Ensure there is a flow to the content, transition between similar topics so the audience does not get lost
- Having a lot of slides is alright, make the content on the slides easier to see and understand
- Allow for audience interaction
  - Utilize polls, as well as question and answer times
- End with a summary and an action plan
  - Give the target audience something tangible they can look back on

(Perera, n.d.)

Source:

Perera, G. (n.d.). *The Secret Formula for Webinar Presentations that Work Every Time*. 18.

Example Webpage Design



- This part has other helpful information people may need
- This could include:
  - Information about CHESSA and DMME

- This part is the summary of the webinar, it also includes
  - the webinar duration
  - the date and time of the webinar
- Can also include
  - Location for residents to go to take part in webinar

- This side bar includes
  - Sign up link
  - Presenter information
  - Share links
- Can also include
  - Presenter contact information

Source: https://www.solarenergy.org/webinars/