Addressing Barriers to Utility Scale Solar in Virginia

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Abbreviations

ApCo - Appalachian Power Company
CREA - Charlottesville Renewable Energy Alliance
CZM - Coastal Zone Management Program
DEQ - Virginia Department of Environmental Quality
HB - House Bill
MW - Megawatt
NREL - National Renewable Energy Lab
PBR - Permit-by-Rule
PPA - Power Purchasing Agreement
RTO - Regional Transmission Organization
SB - Senate Bill
SCC - State Corporation Commission
SEIA - Solar Energy Industries Association
VCEA - Virginia Clean Economy Act
DOE - Virginia Department of Energy

Executive Summary

In 2020, Virginia committed to ambitious carbon emissions reduction targets through scaling up renewable energy with the passage of the Virginia Clean Economy Act. However, since this landmark legislation, utility-scale solar projects have become increasingly difficult to develop in the Commonwealth, with the number of denials one short of matching approvals in 2024. Almost 2 million Virginians are threatened by the rising sea levels attributed to climate change, which provides policymakers with a compelling reason to pursue aggressive climate mitigation and adaptation strategies. Virginia's negative trend of approvals is stifling innovation in the clean energy space needed to combat this.

While many factors have contributed to this issue, local governments that restrict solar within their jurisdiction are increasing in number, indicating that there is a key disconnect between developers and localities that prevent growth. This report is aimed at developers facing difficulties in obtaining local permits, with the possible alternatives covering actions available at this level. The Charlottesville Renewable Energy Alliance (CREA) focuses on developing clean energy projects throughout central Virginia and provides developers an opportunity to share best practices and innovative solutions to local opposition.

Utility-scale solar is a very active policy area in Virginia, with local permit denials being the focus of several bills introduced each legislative session. These aim to shift the balance of authority between the state and local level. As none of these bills passed in the 2024 or 2025 sessions, developers are finding other ways to confront this opposition.

The alternatives explored in this report cover this range, with a combination of state legislative and developer-focused options. Drawing on policies pursued in other states as well as a growing body of literature on understanding local opposition to utility-scale solar, this report covers four alternatives:

1. Legislative Change: State law to prohibit restrictive zoning ordinances at the local level
2. Legislative Change: Creation of a large-scale solar technical assistance office
3. Developer Action: Standardize and enhance community engagement practices
4. Status Quo: Allow present trends to continue

These alternatives are evaluated on four criteria: Cost to Developers, Effectiveness, Durability, and Political Feasibility or Citizen Acceptability. **Based on the projected outcomes of each alternative on these criteria, developers should pursue efforts to bolster their engagement practices** based on the existing body of literature on locality preferences on large scale solar development. While option 3 has a higher cost, this is offset by having the highest feasibility and durability. In the current moment, state legislation has feasibility issues and focusing on developer-led initiatives provides a more direct way to address the root cause of opposition.

Acknowledgements

I would like to thank my friends and family who allowed me to talk at great lengths about this project, even if they didn't fully understand what I was talking about. Without the support of those in my life, I would have gotten stuck along the way. A special thank you to my roommates for allowing me to cover a wall in sticky notes so I could visualize the final version of this report.

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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 Statement

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

Matthew Docalovich

Introduction

The years of 2015-2024 are the hottest we have ever experienced, with 2024 officially crossing the 1.5° C threshold set by the Paris Climate Agreement (World Meteorological Organization, 2025). While renewable energy continues to make up more of our energy-generation, global carbon emissions are still increasing. As communities face the intensifying impacts of climate change through disastrous flooding and wildfire events, the need for reducing carbon emissions remains one of the most pressing in our time. Virginia is especially hard hit by climate change through the coastal flooding associated with sea level rise. In fact, the Hampton Roads region, home to almost 2 million Virginians, has been identified as the second-most vulnerable area in the United States to these rising water levels (Steinfeldt et al., n.d.). Extreme heat also threatens the Commonwealth through shifting agricultural patterns and increased public-health risks, as well as increasing temperatures within the Chesapeake Bay (Steinfeldt et al., n.d.). Climate change is a global issue, with localized impacts that must be addressed at all levels of government.

Policymakers across the world are pursuing a range of climate mitigation and adaptation methods to confront these mounting challenges, but decarbonizing the economy is the only way to avoid the worst-case scenario projections. Therefore, economists, scientists, and politicians are turning to clean energy as the long-term solution to preserving our way of life while securing a safe future for generations to come. In the last decade, clean energy technologies have become much more viable options with decreasing costs and improved performance.

Between 2010 and 2020, the average cost of electricity for onshore wind projects decreased by 56% and offshore wind was closely behind with a decrease of 48%, but solar bested both of these with a dramatic decrease of 85% (International Renewable Energy Agency, 2021). This has made solar the cheapest form of electricity generation more frequently. Due to these drops in price, solar has led all electricity-generating technologies in capacity additions since 2021, including an unprecedented 75% of all projects in 2024 (Solar Energy Industries Association [SEIA], 2024). Across the United States, solar also has the highest favorability rating of all energy sources, including fossil fuels, with 78% support (Tyson & Kennedy, 2024). The growing harmony between public opinion and markets present the opportunity for an explosive growth in solar energy to decrease our reliance on carbon. The Commonwealth acknowledged that solar will be the future of a majority of our energy generation, shown by Figure 1 which displays the 2022 Virginia Energy Plan’s projections of future energy-generation sources. Virginia must take advantage of this growing industry to decrease carbon emissions and ensure both a healthy future and a strong economy driven by innovation.

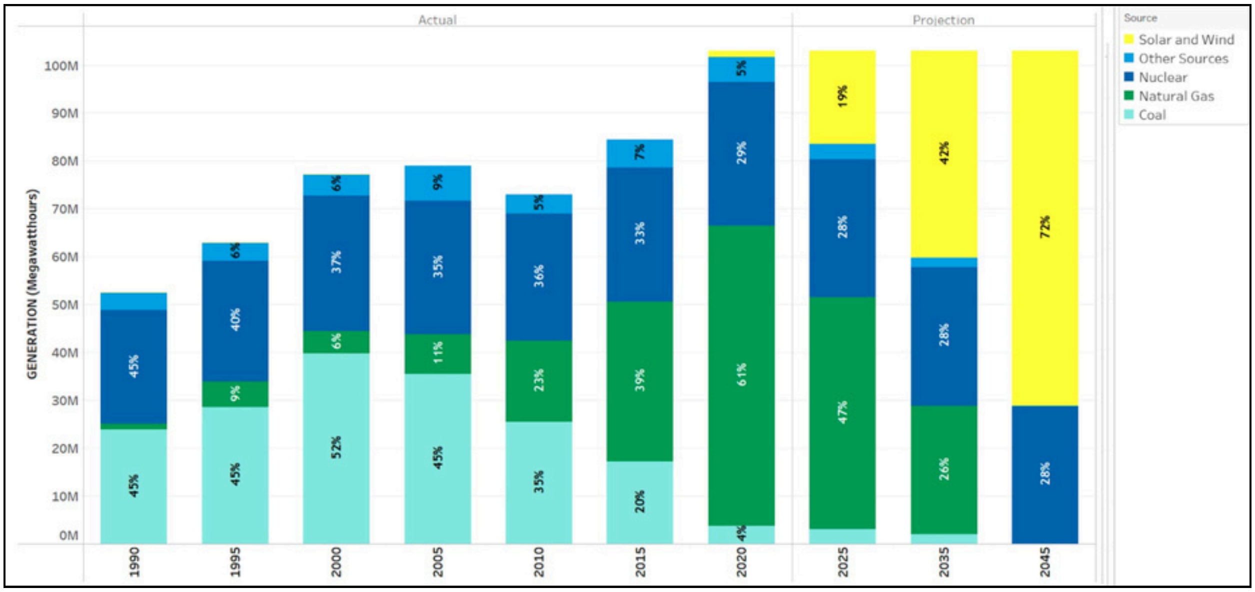

Figure 1: Virginia Total Annual Energy Generation by Source and Future Portfolio Growth
Source: Virginia Department of Energy [VDOE], 2022

Problem Statement

In 2020, Virginia set ambitious clean energy goals through the Virginia Clean Economy Act (VCEA) which declared that 16,000 MW of solar should be added to the grid by 2045 (VDOE, n.d.). However, Virginia has only installed 5,800 MW to date (Virginia Department of Environmental Quality [VA DEQ], 2025). Utility-scale solar projects are an integral piece of transitioning Virginia's energy grid away from fossil fuels toward a more sustainable future and reaching the goals laid out in the VCEA. **However, the development of new utility-scale solar projects has become increasingly difficult in Virginia, indicated by an over 300% increase in local permit denials from 2016-2020 to 2021-2024, which has resulted in a loss of 4,034.98 MW of clean energy potential to the grid (Virginia Solar Initiative, 2024).** *Figure 2* displays this trend of increasing denials in megawattage, while *Figure 3* illustrates the increasing share of permit denials. The amount of solar added in 2024 is the lowest in six years and almost half of all permits applied for were denied or withdrawn. Due to this, Virginia has been identified as one of the most restrictive states in regard to solar energy development (Weise & Bhat, 2024; Eisenson, 2024). This concerning trend is partly driven by local opposition to solar developments, as restrictive local ordinances are used to complicate, stall, and prevent growth.

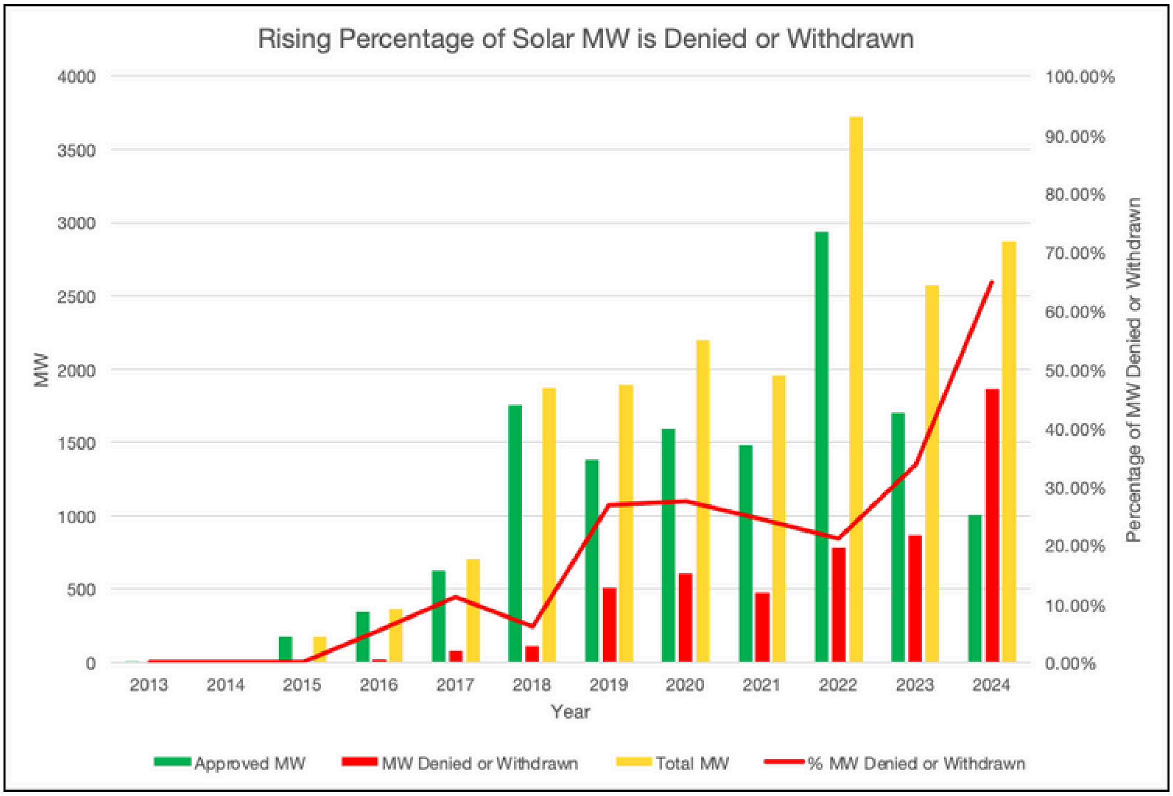

Figure 2: Megawattage Applied for through Permit-by-Rule Process in Virginia by Year
Source: Virginia Solar Initiative, 2024

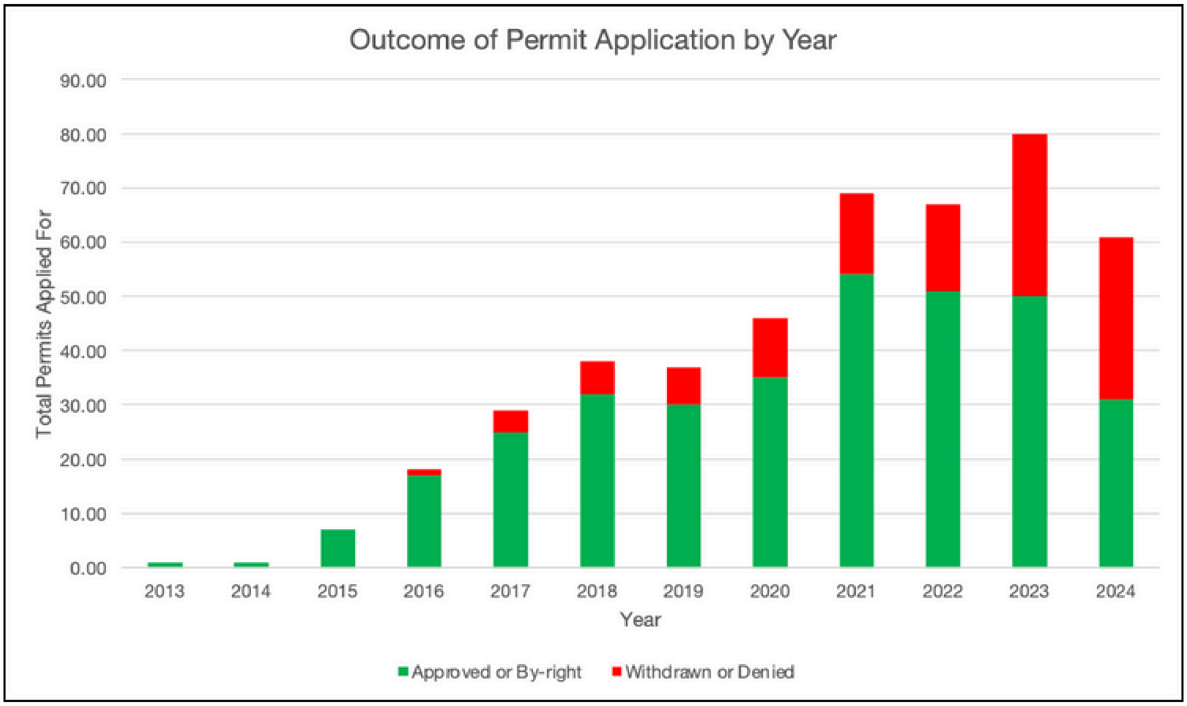

Figure 3: Outcome of Permit Applications by Year, with Approved and By-Right combined and Withdrawn and Denied Combined
Source: Virginia Solar Initiative, 2024

Client Overview

The Charlottesville Renewable Energy Alliance (CREA) is a group of renewable energy companies based in Central Virginia, three of which focus solely on utility-scale solar with three additional companies that have utility-scale solar divisions (CvilleREA, n.d.). The goals of the CREA are to promote clean energy in the Charlottesville and Central Virginia area through connecting stakeholders across the industry, engaging the greater community to improve awareness and support for clean energy, and promoting economic development. The organization does not have its own staff; instead, it is coordinated through the existing companies.

Increased difficulty in developing utility-scale solar projects has been identified as one of the key issues facing member companies today. As the permitting process grinds to a halt, developers cannot move forward, adhere to their mission statements, and derive revenue from their projects. In conducting this research, potential solutions for easing the permitting process could help speed up the implementation of solar energy in Virginia, both achieving the goals set forth for the Commonwealth and helping these companies further their missions.

The CREA's role in addressing the problem of utility-scale permitting is interesting, as there are potential solutions that they can implement themselves, technical assistance they can provide to their utility-scale developers, and broader policy solutions they can advocate for at the state level. Therefore, this provides a great level of freedom in the kinds of recommendations that can be made as both traditional policy solutions and innovative ideas would fit within their ability and purpose. Specifically, it allows for recommendations to range from what companies can implement without greater policy change in their own projects, to the policy change that would address this problem on a higher level to be advocated for through an individual company's policy division.

Background

Utility-Scale Solar

Utility-scale solar refers to larger projects, typically those over 5 MW, that produce electricity to be sold directly to utility companies, primarily Dominion Energy and Appalachian Power Company (ApCo) in Virginia, and added to the greater transmission grid. Developers can also enter into a Power Purchase Agreement (PPA) with specific companies that will be the primary user of the electricity. Projects are measured in total megawattage, not by megawatt hours because this refers to total generation capacity and not what is measured at the meter for consumers. A solar facility's total potential energy is known as its nameplate capacity. Utility-scale solar facilities typically operate for 25-30 years, with emerging technology assisting the increase in this lifespan (Wiser, 2020). Utility-scale is distinctly different from other popular forms of solar generation such as distributed solar generation, community solar programs, and rooftop, which are direct-to-consumer (Asirin et al., 2023; Pitt et al., 2018). The scale of these projects is quite large as each megawatt of generation requires between 5-10 acres of land (SEIA, n.d.a). Additionally, the complexity of the PPAs they enter into with Dominion and ApCo factors into the resistance which has made permitting more difficult in recent years (Burden, 2024). The relative disconnect of utility-scale to people's lives has also been identified as a reason for stronger resistance to these projects compared to residential systems (Carlisle et al., 2016; Gaur et al., 2023; Nilson & Stedman., 2022).

Permitting Process

In Virginia, there are two ways to obtain a utility-scale permit. Projects between 5MW and 150MW must obtain a Permit-by-Rule (PBR) from the Virginia Department of Environmental Quality (DEQ). For an overview of all the elements necessary for a PBR, see *Figure 4*. The application process is laid out in Virginia Code § 9VAC15-60-30. Projects exceeding 150MW are permitted through the Virginia State Corporation Commission (SCC) (Woram, 2021). For reference, 1 MW of solar generation is estimated to have the ability to power around 112 homes in Virginia (SEIA, n.d.b). However, the number of homes is not a perfect measure for how much utility-scale generation the state will require as other uses dwarf household consumption, especially with the rapid growth of 'data center alley' in Northern Virginia (Pipkin, 2024; PJM, 2024). Policymakers should consider total state energy usage since these projects are sold to the grid. Between 2019 and 2023, Dominion Energy connected 94 data centers to the grid which use a cumulative 4GW (4,000MW) (Dominion Energy, 2024).

Both permit processes are complicated and require a local permit before construction can begin, but the PBR requires this permit before state approval while the SCC does not need this before approving an application. This difference sheds light on the issue with local permitting, as the time to obtain one already approved by the SCC is much shorter than that for a PBR (Woram, 2021). A common explanation for this difference is that if projects have already passed state regulations, localities have a more difficult time identifying reasons to reject them. Most solar projects in Virginia, which is true for the member companies of the CREA, go through the PBR process. Therefore, the PBR process will receive the most evaluation with the SCC's Certificate of Public Convenience and Necessity (CPCN) process being used as a point of reference where useful.

Under current regulations, a 30-day public review and comment period is mandated for all projects applying for a PBR. A public meeting is also mandated within the locality. Following these, the developer prepares a report to include any major concerns which is submitted to DEQ with their permit application materials (Va. Code § 9VAC15-60-90). Developers vary widely on the level of public engagement extended beyond these requirements.

Federal Reviews	**United States Army Corps of Engineers** • Jurisdictional Delineation prerequisite • Federal Compliance/Permitting • Section 401 or 404 of the Clean Water Act	**United States Fish and Wildlife Service** • Endangered Species Act Section 7 Review • Habitat Conservation Plan • Incidental Take Permit	**Federal Aviation Administration** Evaluate if a permit is needed based on the FAA Notice Criteria Tool
Interconnection	**Determine the applicable SGIP Level Process Required (1,2, or 3)**	**Interconnection permitting process through PJM**	**Interconnection Certification**
Localities	**Developers submit a Notice of Intent to the locality to begin siting agreement negotiations**	**Required Engagement Elements** • Comment period • Public meeting	**Construction permits and Inspections, additional locality requirements dependent on local regulations**
Virginia Department of Environmental Quality	**Submit a Notice of Intent for a Small Solar Energy Project (5 – 150 MW)** **Submit application for a Permit-By-Rule Permit**	**DEQ Office of Renewable Energy and Coordinated Review Process** • Department of Historic Resources • Department of Conservation and Recreation • Department of Wildlife Resources • HB 206 requirements	**General construction stormwater permit**

Figure 4: Elements Required for a PBR Application
Source: Virginia Solar Initiative, n.d.

Interconnection

Briefly, it is important to consider the complications associated with projects becoming connected to the grid so the energy can be sold, known as interconnection. Throughout the United States, this process is managed by regional transmission organizations (RTOs), with Virginia being covered by PJM Interconnection. RTOs are governed at the federal level, by the Federal Energy Regulatory Commission (FERC) (Ammann, 2023). Currently, the PJM queue for adding a project that requires grid upgrades is years long, potentially exacerbating some of the delays for permitting as developers attempt to find alternate sites (PJM, 2024; Ammann, 2023). Projects officially enter this queue after receiving the relevant permits after conducting interconnection studies to see if connection now is possible or if grid upgrades are needed. However, the queue has been put on hold to reassess the evaluation stages and account for the backlog. The queue is set to reopen for new projects by the end of 2026, causing developers to begin planning ahead (Howland, 2024).

Cause of Denials

There are many reasons a utility-scale solar project may be withdrawn or denied when seeking a permit, or remain in this process for many years. However, the two most cited by developers and researchers are the difficulties associated with local permits fueled by community opposition and interconnection complications (Nilson et al., 2024a; McGowan, 2023). Therefore, this analysis will focus on the local opposition developers face in Virginia, as interconnection is a complicated technical problem that must be solved at multiple levels of government. The reasons for local opposition are understandably varied and must be independently researched for each locality. Some mentioned by those who work on the issue in Virginia are the conflict with other land uses such as agriculture, concerns that the character of the area and land will be negatively impacted, and skepticism about where the revenue from these projects goes. A 2011 U.S. Chamber of Commerce study found that the visual and landscape argument was the most used in legal proceedings to block renewable energy projects (Pociask & Fuhr, 2011). This finding continues, with viewshed impacts remaining the most common reason for opposing a project (Nilson & Stedman, 2023; Bessette et al., 2024). Several harmful misconceptions may be held by a smaller group of constituents, which strengthens this opposition, from the idea that they produce toxic radiation to harmful glare that disrupts airplanes (Simon, 2022).

This local opposition translates to stricter zoning ordinances. Zoning ordinances can directly ban solar or do so through setting unrealistic standards that effectively ban its development. In Virginia, 50 localities have prohibited solar through outright bans or restrictive ordinances (Vaughan, 2024). See Figure 5 for a map of these localities created by the Mid-Atlantic Renewable Energy Coalition. The most common method to restrict solar energy is to set a maximum cumulative acreage that can be used for solar energy in the locality. Other restrictions include the project's maximum or minimum acreage required, distance from another solar facility, and extensive setback distances. As shown in the following section, these zoning ordinances can majorly affect the amount of land available for developers to pursue for building plants.

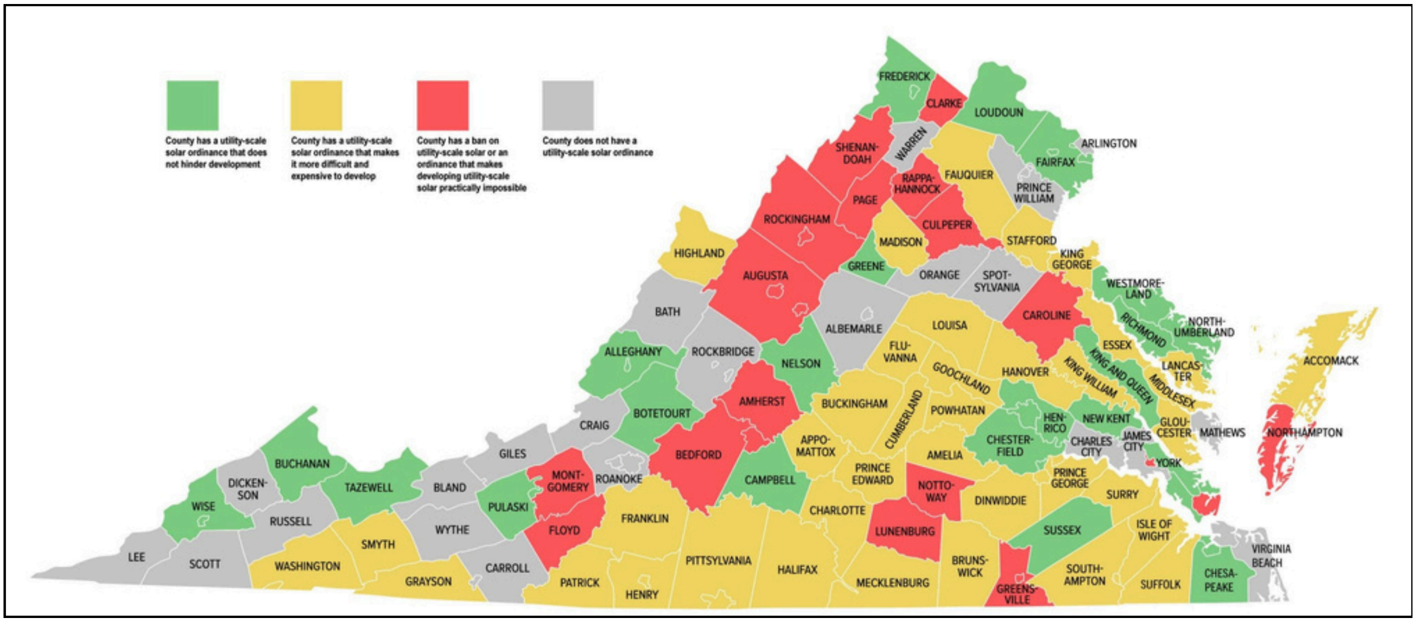

Figure 5: Map of Virginia Showing Localities with Restrictive Solar Policies
Source: Vaughan, 2024

Impact of Zoning Ordinances

The impact of these restrictive zoning ordinances cannot be understated, as they are very influential in the land availability for renewable energy siting. In a comprehensive study of local ordinances throughout the United States, researchers found that specific setback distance requirements, an integral feature of zoning ordinances, can reduce solar resources by up to 38% (Lopez et al., 2023). Setback distances are a common tool within Virginia locality ordinances to restrict solar development. Their methodology was to identify renewable energy-specific zoning ordinances, then perform spatial modelling of these setbacks using the NREL's Renewable Energy Potential model, and then overlay this on suitability map parcels to identify areas in which solar could be sited, defined by the setback parameters, to estimate the amount of generation possible. This is a strong study through its national focus and mapping strategies.

A further illustration of the importance of local ordinances is revealed in a study by the NREL into solar technical potential with three different siting scenarios for the contiguous United States (Lopez et al., 2024). In an 'open' scenario where the only restrictions are physical and legally protected lands, Virginia has a capacity of 2,858 gigawatts (2,858,172 MW). This is compared to a reference scenario, which applies moderate restrictions based on current industry practices, and estimates the capacity at 964 gigawatts (963,990 MW). Finally a limited scenario is drawn from extrapolating the most restrictive ordinances to produce an estimate of 336 gigawatts (336,182 MW). These differences reflect the loss in energy potential due to local ordinances by 66% and 88%, respectively.

A study specific to the Great Lakes region similarly found that restrictive zoning could limit solar deployment by up to 52% (Owusu-Obeng et al., 2024). Their methodology was to isolate available land through the application of current zoning ordinances and land use exclusions to individual land parcels throughout the study region, then create a capacity expansion model to estimate the most feasible and cost efficient sites for construction, before quantifying these through an unregulated scenario, a baseline scenario, and a progressive scenario to represent the possibilities posed by different levels of restrictive ordinances. This methodology is strong as the level of individual land parcels is as specific as technology allows, and the isolation of the most advantageous areas shows the direct effects of zoning ordinances. While the region is geographically different from Virginia, it is similar in the kinds of policy debates and changes surrounding utility-scale siting.

Understanding Opposition

Overall, solar energy has a high favorability rating, but this story changes when looking at specific projects. People support renewables in the abstract, but may oppose a facility being built near their home, known as the “social gap” (Bauwens & Devine-Wright, 2018; Trandafir et al., 2023). In a national survey, researchers found aesthetic perceptions to be the best predictor of support for a project, where those living closest to the plant reported a greater impact (Rand et al., 2024). Another intersection is the rural nature of these projects, which drives the idea of a ‘rural burden’ as they are expected to sacrifice their land and views for energy distributed to urban areas (Nilson & Stedman, 2023). Solar also faces opposition based on environmental concerns, as previously harmful projects did not properly account for water runoff, and the land use is somewhat intensive. This is known as the “greens’ dilemma,” where renewable energy infrastructure is desperately needed for addressing climate change, but environmental groups may oppose building of these facilities (Ruhl & Salzman, 2023). These examples illustrate the complexity of opposition, which is often strongly tied to one’s sense of place and identity.

In a 2022 study by Susskind, et al., seven major sources of opposition were identified as environmental concerns, financial feasibility for the locality, inadequate public participation, insufficient respect for Tribal rights, perceived risks around health and safety, intergovernmental disputes, and land value impacts (Susskind et al., 2022). This further reveals the patchwork of issues that utility-scale solar projects face. The methodology of this study included a review of media and public scholarship to catalog similar characteristics of failed or delayed projects to create a database of 53 cases throughout 28 states related to solar, wind, and geothermal projects. They then created a Boolean-coded spreadsheet to identify similarities and verified these with root cause analyses. This is strong due to the large sample size and qualitative evaluation of stated reasons to find common themes. It is an often-cited source when conducting research into reasons for opposition. It echoes the experiences of developers in Virginia, especially those of environmental concerns, inadequate public participation, and land value impacts.

A choice experiment study into resident preferences in Rhode Island identified how to align solar with public priorities through incorporating these concerns into the decision-making process by monetizing them in the benefit-cost analysis for each project (Gaur et al., 2023). Using a stated preference method, researchers established a willingness-to-pay model through a randomized contingent valuation survey of Rhode Island residents. They utilized conditional and random parameters logit models to measure the identified choices by respondents. This is strong due to the number of concerns they controlled for: the number of acres, visibility level, setback distance, cost, and current type of land use. However, using survey data, which required responses, may skew the willingness-to-pay in a positive direction because the voluntary respondents may support renewable energy more. They conclude that people most support utility-scale solar plants being sited in less visible, industrial, already developed areas instead of farm or forest land. This can help developers determine the sites where they would face less opposition.

Policy Landscape in Virginia

Policymakers and energy advocates continue to debate over which level of government is best suited to handle utility-scale permitting within Virginia, and around the country. In the U.S., 37 states give the power of creating these standards to local jurisdictions, with 14 of these states, including Virginia, having state requirements and localities having the final approval (Enterline, 2024). Solar energy is an extremely active policy area in Virginia, with multiple bills introduced in recent sessions targeting a change to utility-scale solar processes. In 2025, two major bills were debated that would represent significant changes to the authority status quo. The first, introduced as SB 1190 and HB 2126, sought to establish a Virginia Energy Facility Review Board that would develop a uniform ordinance, in addition to mechanisms for developer appeals and enhanced technical assistance (SB 1190; HB 2126). The second was similar, introduced as SB 1114 and HB 2438, and would establish a Solar Facility Review Board to set locality ordinances in line with mandatory clean energy targets (SB 1114; HB 2438). Neither bill passed more than one chamber, but all were accompanied by fierce debate as to whether shifting authority would be effective in creating more solar capacity in Virginia. As these are both avenues which have been pursued in other states, it is important to note and understand these failures and acknowledge how active this policy area is in the Commonwealth.

Appendix A provides detailed information on bills introduced into the Virginia General Assembly regarding utility-scale solar permitting.

Conclusion

While technical problems associated with interconnection and permit approvals contribute to the deceleration of solar power in Virginia, local permit denials and resistance are a root cause which can be addressed individually. Technical problems will continue to be overcome through technological innovation and infrastructure updates, but if the policy landscape remains uncertain then development will remain difficult. Localities have a prominent role in controlling where solar can be developed, affecting the capacity of Virginia as a whole. Without accounting for these negative sentiments, solar will continue to struggle to grow in the Commonwealth. However, developers and policymakers can address the root of public opinion to provide a stable foundation for decades of solar growth and innovation.

Consequences of the Problem

One of the most measurable consequences of these delays is the stall in progress toward VCEA goals as they become more unattainable each year. Virginia's passage of these ambitious goals was hailed as a step in the right direction which could present the Commonwealth as a leading force against climate change. The stalled growth of solar contributes further reliance on fossil fuel energy generation, illustrating a failure to act when faced with an existential threat. As clean energy stagnates, fossil fuels continue operating, with new plants being planned to meet growing energy demand. This raises several equity concerns for vulnerable communities as these are the areas most impacted by the effects of climate change, especially those in coastal Virginia, and by the pollution generated from traditional, fossil fuel power plants (Eghdami et al., 2023; Donaghy et al., 2023). As energy demand in Virginia grows rapidly, especially due to data centers in the northern region, projections anticipate a large gap in the ability of the VCEA's goals to meet these demands, as shown in Figure 6. These concerns are key to keep in mind for building equitable policy and building arguments in support of clean energy.

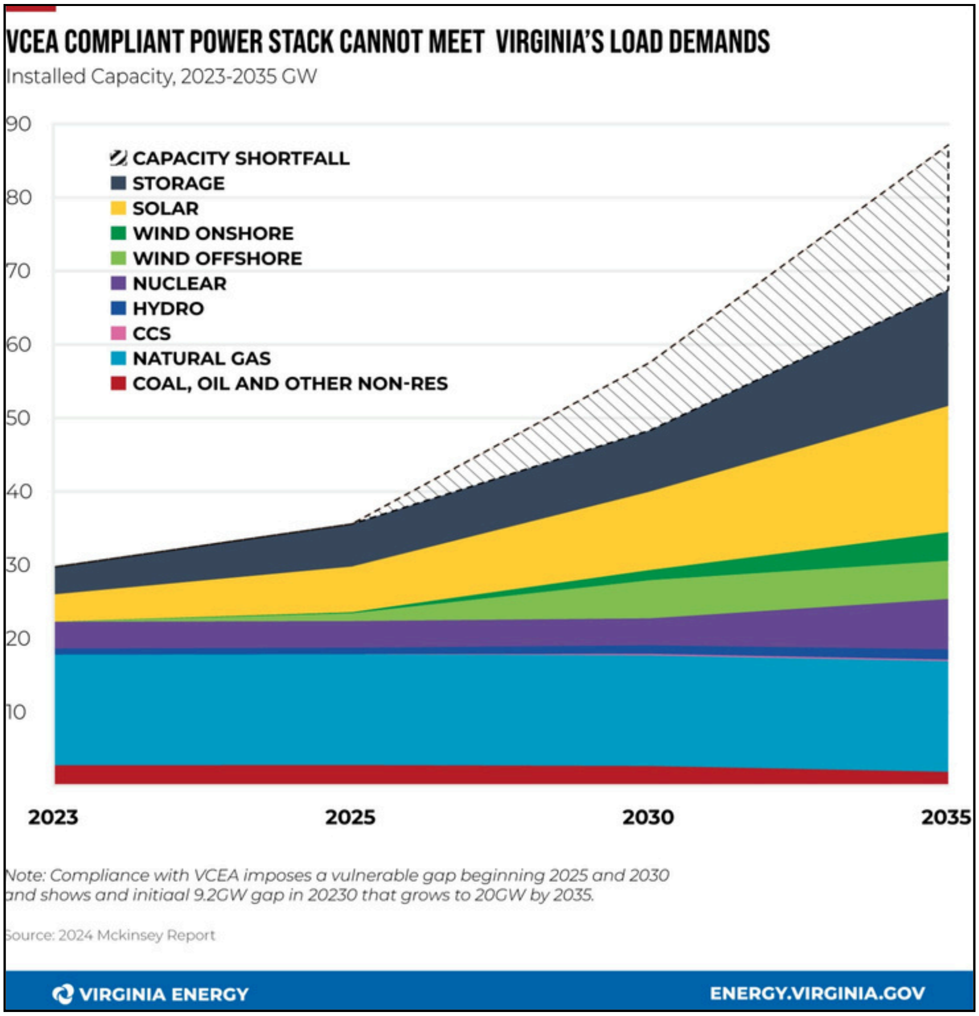

Figure 6: Shortfall in Energy Generation Resulting from VCEA-Compliant Projections
Source: VDOE, 2022

Economic consequences are also important to consider, as utility-scale solar projects provide large investments in the locality in which they are sited in. Arguments in this category mainly revolve around the opportunity cost to localities for not pursuing this revenue. This includes the job potential in construction and operation, lack of funding for public infrastructure, delay in energy grid upgrades, and stagnant energy prices. Another consideration that may be useful in persuading lawmakers is the comparative advantage Virginia loses by not engaging with clean energy as soon as possible, decreasing the relative standing of the state compared to neighboring states (McGowan, 2024).

To better understand the potential economic impact of utility-scale solar projects in a locality, see Appendix B.

Evidence on Potential Solutions

Directly Addressing Local Authority

The most obvious route to address local resistance is to change the system that places so much leverage at the local level. The issue of local resistance is not unique to Virginia, as other states similarly struggle with the siting of utility-scale renewable energy plants due to difficulty in locality permitting (Eisenson, 2024; Enterline, 2024). States have taken different approaches to address the issue, with varying levels of intervention. Some policies have removed local power almost entirely, while others shift the balance.

There are associated limitations of evaluating other state's policies to understand how their successes and failures could be applied to Virginia. First, Virginia is a Dillon's Rule state, which restricts localities to their explicitly given powers by the state legislature and prevents localities from acting as laboratories. This is different from states that follow Home Rule which allow localities to make policies outside their express powers. This limits localities in their potential to implement more novel solutions. Second, these policies are very new. Several of the following state policies have been enacted or updated in the last three years. While this shows how active a policy area utility-scale solar is, it limits the ability to conduct longitudinal effectiveness studies of the policies that could show a more definitive causal link between new policies and utility-scale solar development.

This means that much of the evaluation is more surface-level of state databases on the proposals submitted by developers before and after the policy change. However, evaluating these policies in other states is necessary, as this is a relatively new policy area, and the complexity of local opposition makes it difficult to find more analogous historical reference points. Evaluating these state policy changes is key to identifying possible recommendations, as the opposition is specific to solar.

Lowering the Threshold for State Approval

State-level siting has been Minnesota's policy since 2009, making it one of the first states to formalize this practice (Minn. Admin. Rules § 7854; Minn. Admin. Rules § 7850). Currently, projects in the state produce a total of 1,692 MW, with current proposals expected to more than double that figure by the end of the decade (Orenstein & Steinberg, 2024). The overall lower generation than Virginia can partially be accounted for by the suitability of the state's geography for solar capacity. However, there were significant delays associated with the state process being overly complex, necessitating a new law passed in 2024 to consolidate the process, the effects of which have yet to be realized (Hubbard, 2024). Therefore, Minnesota can serve as a cautionary tale in state-exclusive siting authority as the state-level policy had to be amended. In making policy recommendations, the potential for the state agency to produce similar outcomes to those of the local level should be considered.

In 2011, New York amended Article 10 of its Public Service Law to give a state level siting board the authority to approve renewable energy projects, making it a long-term case study (N.Y Pub. Service Law, Article V; N.Y. GA Bill S7508/A9508B). New York has established a goal of 70% renewable energy generation by 2030 and a zero-emission grid by 20140 (Honig, 2023). The threshold of state-exclusive siting is lower than most other states at 25 MW. The state agency must consider local laws in the application process but is not required to apply these standards if they are found to be “unreasonably burdensome in view of the [state’s climate] targets” (N.Y. Pub. Service Law Article VIII). However, this is not often pursued as the state is hesitant to impose itself in especially resistant localities (Eisenson, 2024; Honig, 2023). This standard would likely apply to many of the restrictive ordinances in Virginia. Despite this, several localities have enacted moratoriums or other restrictions to prevent developers from pursuing projects within their jurisdictions. In some cases, these are preventative, but several have been during project proposals. In the case of Greene County’s effort to block the Flint Mine Solar Project, the state used its authority to override the ban (Eisenson, 2024). Several of the moratoriums remain in place and are only addressed when the issue goes to court, serving as another example that state level siting does not automatically prevent these issues.

<u>Centralizing Siting Authority in a State Agency</u>

In response to the identified issues with Article 10 mentioned above, New York passed the Renewable Energy Growth and Community Benefit Act in 2020. The changes to the system included more centralized decision making through the establishment of a new siting office that exclusively reviews and approves permits, a new and accelerated environmental review process separate than the blanket industrial standard, a strict time limit on how long an application can be processed, required community input, gave the state explicit power to preempt restrictive local regulation, and reassert the power of the state to overrule any ‘unreasonably burdensome’ standards (Honig, 2023). These updates provide a list of new tactics Virginia can incorporate to improve its siting regulation, some of which are not strictly limitations on local authority.

While creating a new centralized authority with the express responsibility of reviewing utility-scale renewable energy applications does involve removing some authority from localities, this can be regarded as a distinct idea as this new division could provide necessary technical assistance without overreaching. Evidence shows that centralized authorities can be helpful in expediting the energy siting process, as a law review of the Californian system identified this as a driving force in the state’s success (DuVivier, 2014). The California Energy Commission was established in 1974 to deal with the influx of nuclear reactors. Now, its main role is to help coordinate the state agencies and jurisdictions involved with utility-scale power plant siting, so its actual ability to make decisions is somewhat limited. Despite this relative lack of decision-making power, it successfully establishes consistent criteria for plant evaluation and provides reports to local governments on the logistics of the facilities.

Restricting a Locality’s Ability to Prohibit Solar

Similar to directly sending utility-scale solar projects to a state-level permitter, states can also set a minimum level for zoning ordinances that prevent the possibility of zoning being used to shut solar out completely. This shifts the balance of power more toward the state, but allows localities to retain more of their autonomy in decision making than the direct state permitting. One of these laws was passed recently in Illinois, which presents a similar case to Virginia, as the state passed a clean energy bill in 2021 with similar aims of greater renewable generation as the VCEA (Illinois.gov, 2021; Eisenson, 2024). Despite this landmark legislation, project approval had slowed due to local reluctance to provide permits, as 15 counties had passed restrictive ordinances (Gearino & Campa, 2023). To address this, the state passed a bill in 2023 to revise the Counties Code to set a standard for the restrictions localities can put in place to prevent ordinances from effectively banning the siting outright (Illinois Counties Code, 55). This law is estimated to have rendered all nine local-level bans invalid (Eisenson, 2024). Since the passing of this legislation, 4,056 MW of utility-scale solar has been planned compared to the 1,311 MW that had come online since 2009 (U.S. Energy Information Administration, 2024). There are no effectiveness studies of this new policy, so the evaluation is limited to the number of permits issued and MW planned which is insufficient to establish a causal link.

Another way of measuring the success of these policies is by evaluating the impact of zoning ordinances on solar capacity. The influence of local zoning rules is discussed in the background section, as they drastically affect the amount of land available for utility-scale solar. Research into this capacity difference indicates that zoning ordinances may reduce Virginia’s solar capacity by up to 88% (Lopez et al., 2024). The idea of setting minimum state standards in lieu of giving the state full authority seems to be gaining traction nationally so continuing to monitor states facing difficulties in this process may provide additional case studies of these policies.

Technical Assistance

Another approach for consideration is that of Washington State, which published a report on the best potential locations for solar plants to encourage development where it is already favorable. While this is not a strict legal doctrine, the pilot program identified “low conflict and highly suitable” areas for solar projects (Weise & Bhat, 2024). This accompanies an exploration by the state’s Department of Ecology into providing additional technical assistance to localities and developers struggling with the siting process. Specifically, the bill hoped to develop streamlined environmental impact statements, consolidate clean energy permits and applications to lessen the burden on developers, and create an interagency council which could help facilitate these changes (Washington State Department of Ecology, n.d.).

Technical assistance is a well-recognized resource in improving outcomes when communities and local governments must make judgments on highly technical matters, especially in scientific fields. Technical assistance often includes individualized assessments, connection with experts, and capacity building so localities feel prepared to evaluate these projects in an evidence-based, systematic manner. Most of the research surrounding technical assistance focuses on its prevalence, with impact studies having varied results dependent on the sector being studied (Scott et al., 2022). For general technical assistance, researchers have identified many ways to design robust technical assistance programs, including adequate preparation, development of a detailed plan, and metrics for measurement of impacts. When considering the impact of these programs, the intensity and focus of the technical assistance is associated with a larger effect size (Dunst et al., 2019).

As solar energy and the methods developers use to determine suitable sites require a deep understanding of energy infrastructure and environmental impacts, technical assistance could provide a benefit to both localities and developers to ensure informational symmetry. While few explicit examples exist for a state technical assistance program with regards to renewable energy development, these programs can provide localities and developers with additional resources to improve communication and mutual understanding. Federal technical assistance programs exist under the Office of Energy Efficiency and Renewable Energy with four programs dedicated to solar resources (U.S. Department of Energy, n.d.). In their general guidance, the Department of Energy and National Renewable Energy Laboratory published guidance for community technical assistance, stressing the importance of understanding the policy landscape, tailoring work products toward this, and repeating consistent messaging (Doris, 2010). Many states pair this technical assistance with one of the above strategies for altering the balance between state and local authority. This presents an opportunity for Virginia to develop a central office within the existing organization structure to address this gap.

What Developers Can Do

In addition to advocating for policy change at the state and local levels, developers may also try to overcome the community opposition fueling ordinance restrictions more directly. To do this, companies must identify the sources of opposition to renewable energy siting and then develop strategies to address these. As an inherent part of solar projects, developers can provide economic incentives to increase support. In Virginia, these most frequently take the form of Machine & Tools (M&T) or Real Estate taxes. However, there is a growing interest in Revenue Share Ordinances, a provision for which was passed in 2020, which provides a yearly flat rate per megawattage of a project (SB 762). In the past two decades, researchers identified a 'social gap' between people's support for renewable energy in the abstract versus their support of a project in close proximity to them (Trandafir et al., 2023; Crawford et al., 2022). While most research surrounding sentiments toward renewable energy traditionally focused on wind, there isa growing body of work centered on utility-scale solar. Developers can leverage these economic opportunities to confront opposition and overcome the social gap (Bidwell, 2016).

Research supports the idea that increased community engagement and investment can improve a locality's receptivity to solar projects, though it mainly consists of correlational conclusions. Some of the most important determinants in baseline community support relevant to solar development are the level of active participation by individuals, the understanding of renewable energy technologies, proximity to development, and other demographic factors (Carlisle et al., 2016; Nilson et al., 2024a; Nilson et al., 2024b; Bidwell, 2016; Lucas et al., 2021; Rand et al., 2024). Developers can increase their support based on the timing of their first interaction, whether the economic incentives are framed as voluntary or mandated, and perception of the developer (Firestone et al., 2018; Trandafir et al., 2023; Kerr et al., 2017; Rand et al., 2024; Carlisle et al., 2015). Research into opposition also reveals that opposition is often driven by a small constituency, creating concern that a democratic deficit is occurring when localities reject utility-scale solar projects. In fact, they conclude that increased communication, earlier engagement, and thoughtful alignment with local values improve large scale solar outcomes (Crawford et al., 2022). Accounting for these factors has shown to improve the likelihood that localities approve of solar projects, providing a method for developers to increase their approval ratings without requiring changes to state law.

The resulting increase from enhanced community engagement in addition to legal requirements is difficult to measure exactly. A survey by Nilson et al. measured the amount of community engagement and whether a project was approved, delayed, or cancelled. Based on this survey, developers increase their likelihood of success by 5%. When accounting for whether or not public input was allowed during the process, approvals increased by 37.93%, showing the importance of people's perceptions of their role on level of support (Nilson et al., 2024a). Additional support can be found that the perception of procedural fairness is important in people's support of specific projects, with the level of influence on the approval process varied depending on existing views of renewable energy and industrial development (Firestone, 2018: Perlaviciute, 2018).

Conclusion

While state legislative changes based on the success of other states provide a direct way to address permit denials, these often create additional tension between states, localities, and developers. Therefore, these options face a feasibility issue as those that have been introduced in the Virginia General Assembly have failed. The lack of strong, causal studies is also a reason for pause in pursuing these as potential alternatives. On the other hand, research into opposition to utility-scale solar is increasing to better inform developer decision making. Without legislative changes, developers must find a way to address local opposition in other ways to reverse the concerning negative trend in permit approvals.

Analysis

In determining avenues to address this problem, alternatives are differentiated by the actor responsible for implementation. Two alternatives will require state legislation, while the third can be implemented by developers themselves. Both categories will seek to overcome local opposition and facilitate the increase of total megawattage approved for utility-scale solar. In addition to effectiveness, measured by megawattage approved per year, alternatives will be evaluated by durability, costs to developers, and feasibility (political or acceptability by citizens).

The state legislative alternatives considered are a prohibition of local ordinances that prevent solar, and creating a state agency that is tasked with providing technical assistance without coercive power. The developer action considered is increased community engagement and education. Finally, these will be compared to the status quo alternative which evaluates the implications of letting present trends continue.

Criteria

<u>Cost to Developers</u>

This criterion measures the direct expected cost to developers resulting from each alternative. This is important to consider because alternatives may be highly effective, but impossible to implement because they are cost-prohibitive. Cost is only measured as those incurred by developers due to the interests of the CREA. Additionally, it allows alternatives aimed at legislative and developer action to be directly compared. It has a weight of 20% because the cost of each alternative is minimal compared to the cost of a solar project (~$1 million per MW) (Coldwell Solar, n.d.; Bongard, 2024), but it should still be a consideration.

Rubric

Low (1)	Low-Medium (2)	Medium (3)	Medium-High (4)	High (5)
$250,000 +	$200,000 - $250,000	$150,000 - $200,000	$100,000 - $150,000	$50,000-$100,000

<u>Effectiveness</u>

This criterion tests the effectiveness of each alternative based on the amount of megawattage it would result in being approved. It is measured as total megawattage approved because this is the most important outcome in tracking progress toward the VCEA and reducing carbon emissions from the Commonwealth. The baseline of effectiveness is calculated using average data from Virginia's successful solar projects in past years. As a metric, megawattage approved directly measures the metric within my problem statement, giving it a weight of 25% because it is important that an alternative is achieving this goal.

Rubric

Low (1)	Low-Medium (2)	Medium (3)	Medium-High (4)	High (5)
Megawattage approved <1200MW	Megawattage approved 1201MW ≤ 1600MW	Megawattage approved 1,601 ≤ 2000 MW	Megawattage approved 2,001 ≤ 2400 MW	Megawattage approved ≥ 2,400 MW

<u>Durability</u>

This criterion measures how long an alternative will be successful in improving approval rates for solar in Virginia. Solar development is a long-term game, so an alternative will not be worth the effort if it only lasts for a year or two. The rubric is based on whether an alternative will face immediate challenges and how conducive implementation is for the future of solar. It has a weight of 25% to match effectiveness because the durability of an alternative affects this metric.

Rubric

Low (1)	Low-Medium (2)	Medium (3)	Medium-High (4)	High (5)
Likely to be repealed or weakened to significantly decrease effectiveness	Likely to face immediate legal challenges or protests that halt implementation	Likely to face challenges that complicate implementation in the long term	Resilient to challenges with amendments to the core policy	Fully institutionalized into long-term frameworks

<u>Feasibility</u>

This criterion measures the political feasibility or citizen acceptability of each alternative. It is separated into these two categories to account for the different kinds of interventions. Political feasibility will apply to the legislative options, while citizen acceptability will analyze the level of resistance faced by the other alternatives. This is important to measure because an alternative should only be pursued if it has a high chance of being successful in approval and adoption. Since utility-scale solar is such a contentious topic, considering whether the chance a policy has of passing directly compared to others is important for identifying which the developers should concentrate their resources on. As local opposition is one of the core causes of solar permit stalling, anticipating citizens' reaction is key to an alternative's success. It has a weight of 30% because there are many ways for approval ratings to increase in theory, but they must be possible in practice.

Rubric

Low (1)	Low-Medium (2)	Medium (3)	Medium-High (4)	High (5)
PF: Likely to be introduced, but go no further CA: Staunchly opposed by all citizens to a level recognized by those previously unaware of the conflict	PF: Likely to pass committee, but go no further CA: Opposed by more people than previous with the issue gaining more traction	PF: Likely to pass one chamber of the legislature, but go no further CA: Opposed only by the current opposition coalition	PF: Likely to pass both houses, but go no further CA: Opposed only by a minority of groups with some former opposition members disengaging	PF: Likely to be signed by the governor CA: Accepted by all stakeholders without significant pushback

Alternatives

<u>Alternative 1: Prohibiting Restrictive Local Zoning Ordinances</u>

Description

This alternative requires state legislative action in the form of a law mandating a minimum standard for locality land use ordinances related to solar facility siting. Specifically, this law prohibits excessive or unrealistic setback distances, project-specific acreage, and cumulative locality acreage, density, or megawattage requirements if the project complies with all other land use ordinances. This alternative maintains a balance between state and local power, as localities retain their current permitting rights over developments. Still, the Commonwealth prevents total prohibitions on the construction of new solar farms. It is a direct intervention that removes the ability of a locality to completely shut out solar development.

This concept is not unique to renewable energy; state legislatures frequently establish requirements for local government ordinances, such as mandating a Comprehensive Plan. Regarding utility-scale solar, this is also not a novel idea. In 2023, the Illinois legislature passed a 'ban on bans,' which is a colloquial way to refer to these kinds of policies. Although it cannot be empirically evaluated, this law's passage is worth considering for states facing similar challenges (Illinois Counties Code, 55). Similar laws have been enacted or contemplated in other states grappling with local opposition that delays renewable energy deployment. The response is often mixed, as local governments view this as an infringement on their authority. However, Virginia's status as a Dillon's Rule state creates a different dynamic between local and state governments, given that the state usually limits local governments, which does not explicitly grant power.

Cost

The primary costs of this alternative are lobbying the General Assembly through direct payment and salaries for government affairs staff. This is estimated at $155,875 if three lobbyists are retained at $15,000 each, increasing with additional personnel and payments. These have been averaged using CREA's member companies that engage in advocacy work in the General Assembly. See Appendix C, section 2.1 to see the in-depth calculation. This gives it a rank of 3 on the rubric.

Effectiveness

The effectiveness of this alternative is apparent; if local restrictions are lifted, then more solar energy can be permitted in these localities without the basis of ordinances to deny them. While other reasoning may be found, the legal process will not be as simple as it once was. In calculating the effectiveness, estimates of how much reduction is caused by restrictive ordinances were used from studies conducted in the Great Lakes region, a meta-analysis of restrictive ordinances across the United States, and a survey with Virginia-specific mapping. In comparing the amount of land available to solar under varying restriction levels, we can see the potential for megawattage to be approved in an 'open' scenario without such restriction. However, this alternative will not create an open scenario, so all possibilities are averaged to provide a more realistic picture of the additional solar potential. To see the full effectiveness methodology for this calculation, see Appendix D, section 2.1.

The final calculation for this alternative is that it would result in 2,661.93 MW of solar being approved in a given year. This ranks it as a 5 for effectiveness.

Durability

This alternative is likely to be effective, but the fierce debate it has already caused in Virginia indicates that it may be challenged through courts or protested by several stakeholders. As shown in the evidence section, lawsuits may be used to impede legislation affecting this area. If the legislation is passed, it will be effective in removing a locality's ability to prevent solar in their jurisdiction, but it is not likely to make the issue a settled matter. Therefore, it will receive a 1 on durability as the legislative session after it is enacted will surely see a repeal or amendment being debated, though it is uncertain whether this effort will be successful. Court challenges could also slow the implementation.

Feasibility

The political feasibility of this option is easy to measure, as a similar bill has been introduced during the previous two legislative sessions in Virginia. In the 2024 Legislative Session, it was submitted to the Senate as SB 697 by Sen. VanValkenburg (D-Richmond). Specifically, it prevented a locality from creating an ordinance that placed "limits on the total amount, density, or size of any ground-mounted solar facility" or "any prohibitions on the use of solar panels that comply with generally accepted national environmental protection and product safety standards" (SB 697) if they were within the other requirements for siting of the locality. It was amended after pushback to clarify that the prohibition only applied if the total area under the panels in the locality was under 4% (SB 697). This bill passed its Senate Committee on Local Government and was passed by the full Senate before being continued to the 2025 session through the House Subcommittee on Counties, Cities and Towns.

It was again introduced by Sen. VanValkenburg in 2025 with the designation SB 1114. The 2025 session incorporated it into SB 1190, a bill that sought to establish a Solar Facility Review Board and compel localities to create local ordinances in line with clean energy goals. SB 1190 failed in the full Senate vote after passing the Senate Committee on Finance and Appropriations (SB 1190; SB 697). In the 2025 session, there was a bill, sponsored by Del. Mundon King (D-Prince William), with the same language as SB 1114. This bill passed the House of Delegates and was referred to the Senate Committee on Commerce and Labor, where it was defeated (HB 2438).

Therefore, this alternative gets a feasibility score of 3 because it has shown the ability to pass one chamber, but committees often defeat them.

<u>Alternative 2: Centralized Office for Technical Assistance</u>

Description

This alternative does not directly affect a locality's ability to permit solar projects. Instead, it focuses on creating a centralized office for developers and localities to access resources regarding utility-scale solar siting. The new office will be situated in VDOE. It would address more than just solar, likely encompassing all renewable energy projects with representatives from the DEQ with some additional staff support from related departments. This alternative would indirectly address local opposition by assisting developers with education, outreach, and relationship building. It would connect developers with localities open to utility-scale solar, specifically by creating an overlay for the current geographic suitability map with counties that do not have restrictive ordinances or ones that volunteer to accept projects.

There is precedent within the Commonwealth for such an agency, as a few state agencies provide specialized technical assistance to localities for larger issues. For example, Virginia's Coastal Zone Management Program fulfills this role for the many localities that experience tidal flooding, the Department of Fire Programs provides specialized studies, the Department of Emergency Management offers exercises in addition to their annual training, and the Department of Housing and Community Development provides technical assistance to 11 categories of locality concerns (Virginia Department of Fire Programs, n.d.; Virginia Department of Emergency Services, n.d.; Virginia Department of Conservation and Recreation, VA DEQ, n.d.a). These establish a model the new renewable energy office could follow by connecting to localities.

In 2023, Washington State employed similar logic in response to issues similar to Virginia's. While it did not create a new agency, it developed a set program for environmental impact statements, coordinated the permitting process, created a clean energy siting council, and began researching how to improve the process overall (Washington State Department of Ecology, n.d.). This new system is known as least-conflict solar siting, which provides developers with a mapping tool that includes overlays for geographic suitability and how accepted solar is by the permitting locality (WSU Energy Program, n.d.).

Cost

The cost to developers for this alternative is based on the necessary lobbying fees and the employment of additional personnel, as they would need a role to coordinate with this new state organization. Calculated similarly to the cost of Alternative 1, this is estimated at $210,875 based on staff salaries necessary to advocate for this alternative and then implement it from the developer's perspective. See Appendix C, section 2.2 for additional information on cost calculations. This gives it a 2 on the created rubric.

Effectiveness

The effectiveness of this alternative is measured using estimates of the uptake of technical assistance programs and the impact these have on desired outcomes. Washington State serves as a starting point, but there is only one year of data due to the program's novelty. Therefore, estimates are also drawn from technical assistance programs focused on connecting communities and resources. These are the HUD's Community Compass Program and the IRS's Opportunity Zones program (Scally et al., 2020; Hodge, 2023). Two different ladders were developed for a range of uptake and impact scenarios, with the final estimates averaged from four scenarios. See Appendix D, section 2.2 for in-depth calculations.

This resulted in a 1,964.49 MW scenario for this alternative, giving it a 3 on effectiveness.

Durability

A close point of comparison for this centralized agency is other Virginia departments that offer technical assistance for localities without having direct permitting authority. The Virginia Coastal Zone Management Program (CZM) provides technical assistance to coastal planning district commissions in building resilience by providing resources and technical assistance. However, the agency has no permitting power, as these are granted by DEQ, the Virginia Marine Resources Commission (VMRC), or others, such as federal agencies and courts (Center for Coastal Resources Management, n.d.). In each of the last six years, CZM has issued technical assistance grants to eight locality planning district commissions (VA DEQ, n.d.b). There is likely to be increased controversy surrounding this agency, and the novelty of the issue may require changes in its functioning.

This results in a durability rating of 4 for the centralized agency providing technical assistance.

Feasibility

A version of this alternative has also been a bill proposed to the state legislature, but it has not been successful. The versions that have been introduced are in the form of SB 1190, introduced by Sen. Deeds (D-Charlottesville), and HB 2126, introduced by Del. Sullivan (D-Fairfax), included some semi-coercive elements, by prohibiting locality bans, requiring their comprehensive plans to include clean energy targets, and establishing an advisory board that localities must consult. Based on the year-long efforts of the Commission on Electric Utility Regulation, there were concerns about earlier proposed versions that did give the new state agency power to overrule localities (Larsen, 2024). The State Senate version passed its Finance and Appropriations Committee but failed the full chamber by one vote (SB 1190). The House of Delegates version was left in the Labor and Commerce Committee (HB 2126).

If introduced as purely a technical assistance agency to help address the gaps between developers and localities, it is more likely to be successful from the standpoint of passing the legislature based on history. However, it would be costly, as the two previously discussed bills did not calculate costs as part of their impact statements. If it is similar to CZM, then it will have an annual budget of around $3 million without the political benefit of federal funding (VA DEQ, n.d.c). This decreases the likelihood of passing, especially if the solar industry questions the effectiveness and local government interests strongly oppose a perceived overstep of their authority.

This alternative receives a 2 on feasibility despite the checkered legislative history, weak support by solar advocates, and high cost to the commonwealth, as this issue will continuously arise in session. If coercion is not acceptable to localities, then a technical assistance agency may be the effort developers rally behind.

<u>Alternative 3: Enhanced Community Engagement, Education, and Involvement</u>

Description

This alternative is a developer action to establish a procedure and best practices for pursuing community engagement and education when beginning a project to test its viability. Developers can involve the community before making key decisions rather than pursue the typical decide-announce-defend structure of starting a project. Through this, developers will understand the needs of the community and have the ability to cater their economic incentives toward these. Developers can incentivize an area in many ways, from choosing a revenue share ordinance in addition to M&T taxes to community benefit agreements. By understanding this up front, developers could avoid areas where they will be denied and increase their likelihood of approval.

These community benefits agreements and financial incentives often take the form of direct, individual payments or collective benefits, including general capacity-building support for the community.

In a survey of developers nationwide, over 75% of solar projects had a presentation at local government meetings and local meetings with stakeholders. However, more profound engagement steps, such as attending community events, visiting neighbors of the project, maintaining a local presence, and conducting local opinion polls, were far less common (Nilson et al., 2024b). These could be key in understanding and unlocking the potential of areas to welcome utility-scale solar facilities.

While many important considerations exist for communities to become receptive to utility-scale solar, this alternative lays out a systematic way for developers to approach and begin conversations with the community. In doing so, developers and communities will understand each other better, and the incentive structure can be tailored to all stakeholders. The largest institutional change will be the shift from land purchasing to community engagement at the beginning of project development. This will decrease the likelihood of developers dedicating resources toward a project destined to fail.

Cost

The cost to developers for this alternative is attributed to staffing costs for going into the community and developing relationships to understand whether it is a suitable area and what developers must prioritize in their economic incentive packages. Then, the estimated value of these incentives is added. For an in-depth calculation, see Appendix C, section 2.3. This aggregates to $206,200, ranking this alternative a 2 on the criterion.

Effectiveness

The calculation of effectiveness for this alternative was based on a survey of projects that measured the level of community engagement and the project outcome. The effectiveness heavily depends on the kind of engagement pursued, what point in the process this engagement occurs, and how receptive developers are to input from the public. For further information, see Appendix D, section 2.3. Using a range of potential impacts based on these, the result of this alternative is estimated to be 2,092.89 MW, giving it a 4 on effectiveness.

Durability

As this alternative is designed to be flexible based on each unique developer-locality relationship, it is unlikely to look the same for every community. As developers continue to refine their practices, the system may change. However, the framework would remain largely untouched with the order of operations changed so that developers could test the viability of a community before deciding to site somewhere. Therefore, this alternative receives a 5 on durability.

Feasibility

This alternative will be ranked by the citizen acceptability metric rather than political feasibility because it requires people's support to be successful. As the core of this issue is local opposition, ensuring that alternatives, not changing state law, address this local opposition is essential. The direct outreach method is proven effective for renewable energy projects, with early engagement correlated to higher satisfaction levels on the developer and citizen sides. While opposition to solar is currently small and organized, their influence could be diminished through proven benefits from the project (Carlisle et al., 2015; Bessette et al., 2024; Crawford et al., 2022). Therefore, this alternative receives a 4 on feasibility.

<u>Alternative 3: Letting Present Trends Continue</u>

Description

An important alternative to consider is continuing with the status quo, as solar is still being developed within the Commonwealth. This would see the permitting process changed at neither the state nor local level. At the local level, governments can enact the zoning ordinances they see fit for their jurisdictions. Developers would continue their project practices as normal, with community interaction unchanged from current practices.

The status quo is a valid option here because of the argument that it is the current system dealing with a sudden overload of applications, in addition to the problems associated with the long interconnection queue. This argument has weight, as the total approved megawattage to date is around 13,000 MW, approaching the goals of the VCEA. However, not every permitted project gets built due to interconnection issues and the VCEA is not the only end goal for clean energy generation within the Commonwealth, especially accounting for the massive increase in demand for energy coming with data centers. The criteria chosen to assess the alternatives are designed to test these assumptions, especially durability and effectiveness, which investigate the ability of the current system to be sufficient in long-term permitting.

Cost

The cost of the status quo alternative is based on cost estimations for the continued difficulty of developing utility-scale solar projects, as a high failure rate is costly for companies. The increased rate of failure is the primary calculation for these projects. To calculate this, the estimated price of an average application is compared with the likelihood of a permit being denied or withdrawn. See Appendix C, section 2.4 for the complete calculation, including a breakdown of the application costs. After calculating the total application costs, this alternative ranks the highest at $260,444.60.

Effectiveness

This alternative will not take any steps to address the issue of local opposition and continue the trend of adversarial relationships between localities and solar developers. Permits would continue to be contested similarly, leading to more denials and withdrawals. Without intervention, we expect denials to exceed approvals, but it is essential to consider if 2024's abysmal 35% approval rating is an outlier.

In identifying this trend, looking at a larger dataset than just one year of change is helpful. Trends from 2018-2024 have been evaluated to get a realistic picture of the landscape. The average percentage change in approvals over this period was -12.92%, with the largest being -47.10% from 2023-2024 (See Appendix D, section 2.4 for full calculations). Permits would continue to be contested, leading to more denials and withdrawals, and more megawattage would be denied then accepted.

When accounting for seven different scenarios (ranging from a 70.76% to a 15% approval rating with these extremes omitted from final calculations), this alternative receives a 1 on effectiveness for the megawattage approved being 929.69 MW.

Durability

The current system is sufficient to allow for some utility-scale permits to be approved for developers. However, letting present trends continue will not affect the increasing rate of denials. In addition to this, the constant news and debate around utility-scale energy permitting at the state and local levels will continue to pressure policymakers to address the issue, meaning it will only become more difficult for developers and state officials to take no action. Therefore, this alternative receives a 3 on durability because it will likely require action by developers, the legislature, or state regulatory agencies before the end of 2026 if the percentage of denials continue to increase.

Feasibility

With current arguments at a fever pitch, as indicated by fierce debate in the General Assembly, this situation is not acceptable to citizens and some lawmakers, who are being pressured to address the issue from either side. Doing nothing to address the growing concerns about solar taking over too much land, or not enough land, is not a tenable option for members of the Virginia legislature. However, it is unlikely that this issue will rise to the prominence of citizens mobilizing for siting to be made easier, as renewables are still being developed within the Commonwealth. The organized opposition is well established and has their sway over enough legislators that all efforts have failed so far. Therefore, this alternative gets a 3 on feasibility.

Outcomes Matrix

	Cost (20%)	Effectiveness (25%)	Durability (25%)	Feasibility (30%)	Weighted Total
Zoning Ordinance Restriction	3	5	1	3	3
Technical Assistance Agency	2	3	4	2	2.75
Community Engagement	2	4	5	4	3.85
Status Quo	1	1	3	3	2.1

All criteria are meant to be maximized, except cost which has been set to minimize. The higher the final total, the more viable the alternative.

Recommendation

This analysis chooses to improve and standardize individual developer community engagement, education, and incentive practices. While this alternative does not change state policy and is therefore weakened by the need for developers to hold themselves accountable, these practices have been shown to improve project outcomes greatly. Several factors determine the success of community engagement, which often correlate to how meaningful the public feels this process is. It is important that developers actively listen to and, when possible, implement the recommendations of communities.

Using a strategically planned and researched approach to community engagement, developers increase their likelihood of getting their project's local permit approved more promptly. One of the most important factors is engaging early (Nilson et al., 2024b; Trandafir et al., 2023; Bauwens & Devine-Wright, 2018). While this extends the timeline for preliminary steps, it will save time in the long term by shortening the local approval process, which has been reported as the most time-consuming part of the permitting process (Woram, 2021).

The cost of this alternative is favorable compared to the status quo, as the initial upfront cost is dwarfed by the risk of several failed applications and the time lost to projects facing significant local opposition. While the cost is higher than advocacy in the state legislature due to the increased expenditure for additional engagement infrastructure and incentives, this increase is somewhat marginal and variable. If communities resist any economic incentive, this recommendation should be re-evaluated.

As the amount of megawattage approved depends on the size of the project, it isn't easy to gauge the exact amount this alternative yields over the others. However, on average, projects are more likely to be approved when communities are receptive to the individual proposal, as attitudes toward renewable energy generally are not a perfect determinant of support (Nilson et al., 2024b). Pursuing these practices more systematically will lead to more approvals than the status quo. It is not as effective as removing the power of localities to block solar altogether. Still, this individual focus may increase the megawattage approved compared to simple technical assistance because it is not seen as an overreach by the state. As this is the most important criterion, it is important to note this tradeoff of durability and feasibility compared to advocating for state legislation on minimum ordinance standards.

This alternative is more feasible than either of the legislative options because it is flexible for developers to implement in a way that is acceptable to citizens. This need for adjusting may impact durability, especially if people begin to see this method as resembling bribery, but this can be circumvented by approaching the community early and portraying it as a requirement of the process (Walker et al., 2015). Ensuring a community’s first exposure to a project comes from the developer can also minimize the ability of a small opposition group to create negative discourse around the project (Crawford et al., 2022). The untenable nature of the current system, both for localities and developers, reveals this alternative as superior to the status quo.

Developers can take this action now while the state legislature and regulators grapple with how to address the problem through policy. While a policy change may occur, it’s key to plan for a range of possibilities given the uncertainties inherent to the Commonwealth’s political landscape. By institutionalizing these practices, developers will only improve their outcomes, as local opposition may manifest in other ways to slow the process of utility-scale solar development even if laws are changed.

Implementation

As shown, the needs and values of areas may differ significantly, which heavily impact the final agreement between communities and developers. There is a need for transparency and trust between developers and localities, which can only be achieved through purposeful and genuine implementation. The success of this alternative hinges on the ability of developers and communities to engage in this work.

In practice, developers should systematically assess a community's priorities and tailor their interactions toward these. Most importantly, a locality should be approached before any formal project announcement. These early interactions should gauge whether the community prefers private or collective benefits, the area's economic needs, the current percentages of residents in support/opposition/uninterested in solar, the most significant concerns, and if outside forces drive any misconceptions. Once these are understood, developers can adjust their public events to account for all opinions within a locality.

Adoption

As this alternative consists of developer-forward action, the adoption will be reasonably simple through new directives from the CREA to their utility-scale solar member companies. For this to be accepted, the CREA should introduce the idea of standardizing their community engagement process in the regular meetings of their solar team. During these, developers can learn about the intricacies of meaningful community engagement and how this may differ from their current practices. Developer perspectives will be key for adjusting the system for additional durability and effectiveness. After incorporating this advice, the CREA should provide resources and support through training for their member companies before implementation. Once developers have agreed upon the system, the CREA can integrate these practices into the development process.

While the logistics of adoption are straightforward, imploring developers to change their ways may be more difficult. For this alternative to be effective, developers must understand the reason for these new practices because their commitment is integral to their success. There is some hesitancy surrounding public engagement within developer circles due to previous negative experiences (Nilson et al., 2024b). However, research shows that people's perception of the individual developer being open and transparent has the largest effect on their belief the process is fair, which leads to additional acceptance of the project (Firestone et al., 2017).

Timeline

Once the CREA adopts the updated practices, each developer must develop a systematic way to engage individual communities. Each company's current outreach, policy, and development team should have an ideas generation meeting to determine how the recommendations from the CREA would best fit within their system. Then, companies should train their project developers and public engagement officials on the updated standards. Finally, there is flexibility for companies to decide if they want to follow these practices for all projects moving forward or begin a few projects with them to ground-truth the new methods. Therefore, this alternative could follow a pilot study model if there are high levels of skepticism.

Materials Needed

Products that need to be developed for implementation are: a training by the CREA for developers, meeting agendas for the CREA and developers, a concrete list of considerations to be tailored by each company after these sessions, a training based on these for each individual company, and other standardized materials for the engagement. For example, a sample public survey for areas to understand their thoughts on solar and receptiveness to new projects.

Stakeholders

The stakeholders with the most involvement in implementation will be the CREA, their utility-scale solar company members, and the communities projects are being pursued in. Other important perspectives to consider are the local and state governments, as well as government regulators at DEQ. The CREA could tout these practices as a reason for joining the organization and becoming engaged through the additional value provided by having a proven method of overcoming local opposition. Communities, and their diverse factions, are important to consider as their buy in is necessary for success. Finally, developers oversee the implementation of these practices on the ground.

Monitoring Performance

Developers should continue to measure the levels of support and pushback from communities to see if these practices are truly effective. A handful of projects are unlikely to reveal a clear result, so developers can share information based on what has been most successful for them. The CREA can collect this data by measuring the approval rate of local permits for projects utilizing this new system versus traditional practices. Other important data include the length of time spent in the community, whether the land was purchased before the public became aware of the interest by solar developers, key concerns voiced by the locality, and whether previous projects within this jurisdiction were successful. By comparing these, the CREA will understand the impact of enhanced community engagement, education, and involvement on the likelihood of a project being approved more efficiently.

Challenges

Key challenges to the success of this alternative in the implementation stage include the risk of projects failing and, in turn, discouraging developers from the changes, the hesitancy of localities with entrenched opposition to accept projects regardless of the level of engagement, and changes in state law exacerbating existing animosity between communities and solar developers. These can be addressed through commitment by the CREA to the viability of these tactics, persistence in trying this new method in various areas, and beginning this process before any state intervention is achieved.

Conclusion

The enormity of the climate crisis is sometimes so overwhelming that it seems insurmountable, but the issue can be broken down and addressed on smaller scales. Virginia plays an integral role in this, and the growth of clean energy within the Commonwealth is a big step in the right direction. In order to make this step, utility-scale solar permits need to increase quickly. The issue of local opposition is a nontechnical barrier standing in the way of this growth. To overcome this, developers choose from a range of potential options. In some states, policymakers change the laws to surpass local permitting authority. In others, like Virginia, the debate continues regarding the optimal balance between these two levels of government. However, in waiting for potential state law changes, developers can refine their community engagement practices informed by studies into what factors increase public support for solar farms, and then tailor their economic incentives toward these for each community. In doing so, developers and localities build strong bonds that benefit both parties and the environment.

Appendix A: Legislative History in Virginia

Utility-scale solar, and renewable energy generally, has been a very active policy area in Virginia for the past decade. Due to this, legislators and regulators are constantly working with localities and developers to update policy to reflect the changing landscape. State policymakers are aware of the increasing difficulty facing developers at the local level, and have introduced a variety of bills to address it. As the increase in permit denials became most prominent in 2023, the 2024 and 2025 Legislative Sessions in Virginia had the most bills directly addressing this issue. This appendix refers only to these bills directly related to utility-scale solar, as general utility infrastructure legislation has also been considered during this time. Many of these bills resemble those of other states discussed in the Evidence section. While similar, both Legislative Sessions are important for understanding the full policy landscape.

Section 1: 2024 Session

Section 1.1: HB 636/SB 567

House Bill 636 was introduced by Del. Sullivan (D - Fairfax) and was titled *Siting of energy facilities; approval by the State Corporation Commission* (HB 636). Its companion bill, Senate Bill 567, was introduced by Sen. Deeds (D - Charlottesville) (SB 567). This bill sought to lower the threshold for projects undergoing the SCC's approval process from 150 MW to 50 MW. This allowed the projects to get a certificate from the SCC without needing approvals or permits from the locality. This approach is common in other states and represents a great shift in power toward the state government. A developer could submit an application directly to the SCC if the locality failed to act in a timely manner, it is denied even when in compliance with requirements, or the "locality amends its zoning ordinance after it has notified the applicant that its requirements are compatible with the requirements for Commission approval, and the amendment imposes additional requirements that are more restrictive" (HB 636; SB 567).

SB 567 was referred to the Senate Committee on Commerce and Labor where it was continued to the 2025 session. HB 636 was referred to the Committee on Counties, Cities and Towns before being moved to the Committee on Labor and Commerce where it was assigned to a subcommittee. From this subcommittee, it was continued to the 2025 session with a voice vote.

Section 1.2: SB 697

Senate Bill 697 was introduced by Sen. VanValkenburg (D - Richmond) and was titled *Solar and energy facilities; local regulation*. This was the first bill that sought to limit a locality's ability to enact restrictive zoning ordinances based on total amount, density or size. It also stipulated that "prohibitions on the use of solar panels that comply with generally accepted national environmental protection and product safety standards" would not be valid, as long as all other local ordinance provisions were met (SB 697). It was sent to the Committee on Local Government where it passed on a vote of 9-6 with no abstentions. Then, it was read to the full Senate and an amendment was added that this prohibition would only apply to localities where the total area under panels was less than 4% of total land in locality. It then passed the Senate on a narrow 21-18 vote, with one Senator missing the vote who had a stated intention of voting in favor. Finally, it was continued to the House of Delegates where it was referred to the Committee on Counties, Cities and Towns before being further assigned to a subcommittee. This subcommittee held a successful voice vote to continue the bill to the 2025 Session.

Section 2: 2025 Session

Section 2.1: HB 2438/SB 1114

House Bill 2438 was introduced by Del. Mundon King (D - Prince William and Stafford) and was titled *Solar facilities; local regulation, special exceptions* (HB 2438). A companion bill was introduced as Senate Bill 1114 by Sen. VanValkenburg (D - Richmond) (SB 1114). This is seen as the successor to SB 697 as it was continued to the next session. This bill sought to to allow solar facilities "on property zoned agricultural, commercial, industrial, or institutional shall be permitted pursuant to various criteria to be included in a local ordinance, such as specifications for setbacks, fencing, solar panel height, visual impacts, and grading, and a decommissioning plan for solar energy equipment and facilities, unless otherwise permitted by right" (HB 2438). Essentially, this bill set ordinance guidelines but left local review and approval intact. This bill serves as the analysis of a 'ban on bans' in Virginia.

HB 2438 was first referred to the Committee on Labor and Commerce before being rereferred tothe Committee on Counties, Cities and Towns where it was assigned to a subcommittee. This subcommittee voted to report it back to the main committee on a vote of 7-1 where it was further reported from the Counties, Cities and Towns committee on a vote of 12-8. Finally, HB 2438 was read before the full House of Delegates twice, after which some substitutes were agreed to that did not change the essential nature of the bill. On the third reading, the bill passed on a narrow 48-46 vote with 6 delegates not voting, one of which indicated they would have voted against it. In the State Senate, it was referred to the Committee on Commerce and Labor where it died.

SB 1114 was first referred to the Committee on Local Government before being rereferred to the Committee on Commerce and Labor. In this committee, it was incorporated into another solar siting bill, SB 1190 which died in a full Senate vote. For more information on SB 1190, see the following section.

Section 2.2: HB 2126/SB 1190 and SB 1434

House Bill 2126 was introduced by Del. Sullivan (D - Fairfax) and was titled *Va. Energy Facility Review Board & Virginia Clean Energy Technical Assistance Center; established* (HB 2126). A very similar bill, Senate Bill 1190, was introduced by Sen. Deeds (D - Charlottesville) and was titled Solar photovoltaic projects; siting, decisions of localities, etc (SB 1190). The bill sought to create a committee of state employees that would advise local governments on solar, known as the Virginia Energy Facility Review Board.

The Review Board would be responsible for establishing a model ordinance consistent with the siting of solar energy facilities. These ordinances would then be reviewed for compliance with the Commonwealth's Clean Energy Policy. Developers would be responsible to submit an application to the Review Board when seeking a critical connection project.

It would also have established a panel of researchers from Virginia's public universities to study the state of solar permitting in the Commonwealth. This body would be responsible for providing technical assistance to state agencies, planning district commission, localities, the Review Board, and other necessary parties. As a coercive element, it would have required every planning district commission in Virginia "to adopt a regional energy plan to address energy generation, storage, and use that demonstrates a meaningful contribution to Commonwealth's energy goals as determined by the regional energy report issued by the Review Board and to submit the plan to the Review Board" (HB 2126).

HB 2126 was referred to the Committee on Labor and Commerce, then assigned to a subcommittee that laid it on the table with a vote of 4-1. SB 1190 was referred to the Committee on General Laws and Technology before being referred to the Committee on Commerce and Labor. Then, it was rereferred to the Committee on Finance and Appropriations due to concerns over the cost to the Commonwealth. In this stage, it incorporated the aforementioned SB 1114 sponsored by Sen. VanValkenburg and SB 1434, sponsored by Sen. McPike (D - Prince William and Manassas). SB 1434, titled *Solar photovoltaic project; decisions of localities, regional energy plans* sought to create regional planning targets for energy production and efficiency. It also included provisions for an Interagency Solar Advisory Committee to review project proposals to provide an opinion for localities (SB 1434). SB 1190 then passed the Finance and Appropriations committee on a 10-4 vote. After a series of substitutes presented and votes held, the bill finally failed a full Senate vote by a margin of 19-20 with the sole senator not present signaling their intent to vote against the bill.

Conclusion

This appendix shows the political difficulties facing utility-scale solar legislation which aims to exercise more state authority than the status quo. This informs my alternatives directed at advocacy for state legislative action. While none of these bills have been successful, the attention by policymakers indicate that they will continue trying for a solution if the permit denials continue to iincrease.

Appendix B: Economic Benefits for Localities from Utility-Scale Solar Projects

In Virginia, utility-scale solar projects are subject to two different kinds of economic incentive structures between developers and localities. The first is the Machine & Tools (M&T)/Real Estate Tax, which is the default option for a tax based on capital investments (Va. Code § 58.1-3660). The second, and fairly new, is a revenue share ordinance which provides up to $1,400 per megawatt on the nameplate capacity (Va. Code § 58.1-2636). Localities must choose between these two options when negotiating the siting agreement with the developer as adopting a revenue share ordinance grants an exemption on taxes to the developer. In some cases, the siting agreement will include a combination approach where the facility will operate with a tax system unless a revenue share ordinance is adopted by the locality.

The amount of an M&T tax varies based on several factors. These are the value of initial capital investment, the schedule of exemptions applied to utility-scale solar projects per Va. Code § 58.1-3660, the depreciation schedule applied by the SCC or the locality, the nameplate capacity of the project in megawatts, and the local tax rates. Some of these factors have further nuance within them, with the tax rate, depreciation schedule, and exemption rate dependent on the size and owner/operator of the project. For example, projects operated by an electric company (Dominion Energy, Appalachian Power Company, Old Dominion Power) are subject to different standards even if they are the same size as other projects not owned by an electric company (Virginia Solar Initiative, 2023). For an in-depth explanation of these complicated taxes, see the Virginia SolTax Tool from the Virginia Solar Initiative.

In 2020, Virginia passed SB 762 to establish a revenue share ordinance as an alternative to taxes for localities to derive value from solar projects. It is much simpler than M&T taxes as it requires a yearly flat rate of a certain dollar amount per megawatt on the nameplate capacity. This rate cannot exceed $1,400 in the first year, but an amendment passed in 2021 allowed localities to increase the rate by 10% every five years starting in 2026 (Virginia Solar Initiative, 2023).

The average nameplate capacity of utility-scale solar projects operating in Virginia is 53 MW. Using this, the highest potential revenue share ordinance would provide the following table of benefits:

Year	**Tax per MW per year**
0-5	$1,400
5-10	$1,540
10-15	$1,863

15-20	$2,050
20-25	$2,255
25-30	$2,480
30-35	$2,728

Further assumptions are: the capital investment is $53 million (in line with the median estimate of the cost of a utility-scale solar project), the discount rate is 6%, the total land acreage is 800 acres, and the base value of the land is $1,000 per acre. For the following calculations, we also assume that the solar facility will operate for 35 years, which is seen as the upper limit.

If a locality adopted the maximum revenue share value, then the locality would net a total of $1,126,000 (in 2020 dollars) from a 53 MW project.

The value of this facility under a tax system is more difficult to calculate based on the complicating factors of the involvement of an electric company and the differing locality rates. However, as an example, under the real property rate of Albemarle County ($0.84), then the tax system would provide an economic benefit of $915,000 over the same time.

Conclusion

These calculations show that the potential revenue for localities should not be overlooked when discussing these projects, as the economic impact of utility-scale solar facilities is valuable for local governments and communities. These represent the economic incentives written into the Virginia Code and do not include the potential payments from developers to nearby landowners or other community organizations. By leveraging these, developers increase their likelihood of project approval at the local level.

Appendix C: Methodology for Cost Criterion Calculations

Section 1: Initial Costs of Utility-Scale Solar Projects

It is important to reiterate that this cost criterion represents the cost for developers to implement the alternative. Therefore, it does not include the cost to governments for implementation, though these are considered in the political feasibility criterion.

To assess alternatives related to state legislative action, the costs associated with lobbying and employing policy-oriented staff are utilized to create estimates. To evaluate the alternative of increased community engagement, education, and investment, engagement staff and potential incentive increases are factored in to develop estimates. Current estimates of solar project development in Virginia are used to determine the status quo costs, accounting for the continued increasing difficulty of project approvals.

Estimates vary widely for the cost of developing a utility-scale solar project as many factors (size, timeline, distance to current transmission infrastructure, cost of land, labor costs, technology costs, etc.) influence the final expenditure developers need. The Kleinman Center for Energy Policy estimated the price to be $500,000 - $700,000 per megawatt produced based on 2020 data (Daniels & Wagner, 2022). However, prices have increased considerably since then; a recent estimate from Coldwell Solar places the cost at between $890,000 and $1.01 million per megawatt. A similar estimate based on 2024 data from Angi ranges from $800,000 to $1 million per megawatt.

The cost of leasing land has increased to an average of $1,500 per acre per year in Virginia with a typical 40-year term (Mohler, 2020). This contrasts with the $800 per acre per year leases that have been common in the past 10 years (Mohler, 2020). Land costs may increase due to dwindling availability with more solar development, landowners' recognition of solar's growing value, competition with agricultural use, and other factors.

Section 2: Alternative Calculations

<u>Section 2.1: Alternative 1</u>

Lobbying Costs

Lobbying costs will be measured using public data from VPAP, with an average taken from the past two legislative sessions (2024-2025 and 2022-2023). The only two utility-scale solar CREA members who contributed over this period were Apex Clean Energy and Sun Tribe Solar. The average over this period was $29,500 (VPAP.org, n.d.a; VPAP.org, n.d.b). Apex Clean Energy retained two lobbyists from Lamar Consulting, besides their government affairs staff, which will be accounted for next. The modest estimated cost is $15,000 based on VPAP's average lobbyist pay report from 2022 (VPAP.org, 2022).

Staffing Costs

The average salary for a government affairs employee of CREA companies is $77,500 based on mid-range estimates from Glassdoor (Glassdoor, n.d.a; Glassdoor, n.d.b; Glassdoor, n.d.c; Glassdoor, n.d.d). Some companies employ two people for this role, which is $116,250. This bill would not require an additional staff member, but they would likely dedicate most of their time to this effort. Being conservative, we can assume 70% of their time would go toward working on this issue, so that the total cost would be $81,375.

Total

Therefore, the total estimated cost of this option is $155,875 if three lobbyists are retained.

<u>Section 2.2: Alternative 2</u>

This option is calculated similarly to the above, with additional staffing costs to coordinate with the agency once it is created. Assuming the salary is similar to that of current government affairs employees, it is the previous cost estimate for an additional employee. The cost is estimated at $210,875.

<u>Section 2.3: Alternative 3</u>

Staffing Costs

The costs associated with this alternative would be staff dedicated solely to working with communities to identify their concerns and priorities and forge relationships to increase trust between developers and localities. In addition to this, an increase in potential economic incentives should be considered.

First, CREA member Apex Clean Energy employs, or at some point has employed, a public engagement manager with an estimated salary of $150,000, a media coordinator with an estimated salary of $67,000, an energy marketing specialist with an estimated salary of $105,000, and a field organizer with an estimated salary of $100,000 (Glassdoor, n.d.d). Assuming the public engagement manager dedicates 80% of their time to this role, with each additional role dedicating 20% of their time, this alternative will cost $174,400 in employment costs.

Incentive Costs

The typical revenue share ordinance incentive is an additional $1,400 per MW in addition to M&T taxes (Va. Code § 9VAC15-60-90). If this alternative leads to an increase of this incentive to an estimated $2,000 to account for additional payments, then this alternative will add a cost of $31,800 using the average MW value of 53 to the initial cost of a development.

Total

In total, this alternative’s cost is estimated at: $206,200.

Section 2.4: Alternative 4

First, to measure the cost of letting present trends continue, we must estimate the average cost for applying for a permit. If denied or withdrawn, the developer incurs this cost without generating any revenue.

Application Price

To illustrate the difficulty in calculating costs for developers to successfully execute a utility-scale project in Virginia, I have compiled the average cost of simply applying for permits from state and local governments.

- The Virginia Department of Environmental Quality's PBR fee is variable based on megawattage (Va. Code § 9VAC15-60-110):
  - >25 MW up to and including 50 MW: $10,000 fee
  - >50 MW up to and including 75 MW: $12,000 fee
  - >75 MW up to and including 150 MW: $14,000 fee
  - Permit by rule modification: $4,000 fee
- The Virginia State Corporation Commission charges a variable fee to obtain a Certificate of Public Convenience and Necessity fee necessary for construction of a development more than 150MW (Virginia State Corporation Commission, n.d.)
- Locality permit fees vary based on the Conditional Use or Special Use permit application fee, building permit fee, and some localities have different categories for utility-scale solar. Some examples are:
  - Brunswick County Conditional Use Permit application fee for Utility Scale: $3,500 (Allen, 2021)
  - Lunenburg County: $5,000 for solar and utilities businesses (Lunenburg County Virginia, n.d.)
  - Halifax County: $1,000 Conditional Use Permit for Large Scale Solar (Halifax County, n.d.)

These permit applications are accompanied by additional building and construction permits, interconnection studies, environmental impact studies, natural and historic resource studies, and others depending on the locality and site. Developers will undergo these as part of their permit application.

Interconnection fees are incurred even before a project begins, with a readiness deposit of $4,000 per megawatt and a study deposit required with application materials. The study deposit ladder is as follows (PJM, n.d.):

- 0 – 20MW: $75,000
- >20 – 50MW: $200,000
- >50 – 100MW: $250,000
- >100 – 250MW: $300,000
- >250 – 750MW: $350,000
- >750MW: $400,000

Therefore, the total cost estimate to apply for a permit to develop a utility-scale solar plant is between $150,000 and $250,000, with the average estimate being $459,500 for a 689 acre project generating 53MW. These size assumptions are based on the average active permits in Virginia for plants between 5 and 150MW.

Accounting for Present Trends

Second, to measure the cost of letting present trends continue, we must quantify the present trend of approvals and denials. The percentage of permits denied or withdrawn, which could cause the developer to incur the cost of a permit application, for 2024 was almost 50%. Table 1 displays the number of permits applied for by year with their outcome. This establishes the current trend of approvals.

Year	Approvals	Denials	By-right	Withdrawn	Approved or By-right	Withdrawn or Denied	Total Permits	% of Permits Denied or Withdrawn
2013	1.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00%
2014	1.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00%
2015	7.00	0.00	0.00	0.00	7.00	0.00	7.00	0.00%
2016	15.00	1.00	2.00	0.00	17.00	1.00	18.00	5.56%
2017	25.00	2.00	0.00	2.00	25.00	4.00	29.00	13.79%
2018	31.00	4.00	1.00	2.00	32.00	6.00	38.00	15.79%
2019	30.00	3.00	0.00	4.00	30.00	7.00	37.00	18.92%
2020	35.00	7.00	0.00	4.00	35.00	11.00	46.00	23.91%
2021	54.00	12.00	0.00	3.00	54.00	15.00	69.00	21.74%
2022	50.00	12.00	1.00	4.00	51.00	16.00	67.00	23.88%
2023	50.00	25.00	0.00	5.00	50.00	30.00	80.00	37.50%
2024	30.00	26.00	1.00	4.00	31.00	30.00	61.00	49.18%

Table 1: Permit Applications by Year and Status
Source: Virginia Solar Initiative, 2024

As shown by the estimates above, applying for permits is expensive. Withdrawals and denials have been aggregated as the application costs are incurred in both scenarios. Assuming that permit trends stay stagnant in their current position, developers risk losing $225,982.10 for each permit denied. If a developer submits two permits in a given year, which is likely based on the trends of CREA's utility-scale solar members, this is a reasonable cost to assume. If trends worsen by a modest 8%, this cost rises to $262,742.10. If the trend worsens by the same amount as between 2023 and 2024 (11.68%), then this cost rises to $279,651.70. If we take the average over the period 2022-2024 (12.65%), this cost becomes $284,108.85. In a worst case scenario, denials and withdrawals may increase by even more than previous years and rise to 15%, which would cost companies $294,907.10.

Total

Therefore, the range of costs for the status quo is $225,982.10 to $294,907.10. The average is $260,444.60.

Appendix D: Methodology for Effectiveness Criterion

Section 1: Baseline Calculations

To establish the rubric for the effectiveness criterion, a baseline must first be set to measure whether an alternative is successful. This baseline can be established in several ways, such as by using a fixed year or an average over different time periods. The average for 2018-2024 will be utilized to account for the spike in applications in 2022 following the passage of the VCEA in 2020. The year 2018 marked the first time that the total megawattage applied for, and the megawattage approved, exceeded 1,000 MW. The total megawattage applied from 2018 to 2024 is 2,442 MW, with 1,695.15 MW approved. This results in an average approval rate of around 70%.

However, only two years over this period exceed 1,695.15 MW approved (2022 and 2023), as 2022 skews the average with almost 3,000 MW approved in a single year. When 2022 is removed, the total applied for in this period is 2,228.41 MW, with 1,488.11 MW approved. This average approval rating is 66.78%.

Taking the average of these two values, since 2022 should not be entirely excluded, we are left with a baseline of:

- Total Applied for: 2,335.21 MW
- Total Approved: 1,591.62 MW
- Approval Rating: 68.16%

For the rubric, the baseline is rounded to 1,600 MW for simplicity. Between 2018 and 2024, three years exceeded this amount approved, while four were lower (2020 had 1,592 MW approved). This indicates that 1,600 MW is a realistic, if slightly ambitious, goal for Virginia's solar growth. Therefore, this will be set at a medium level of effectiveness because it represents an improvement on current trends.

Section 2: Alternatives

Section 2.1: Alternative 1

This alternative is measured using impact evaluations of restrictive local ordinances to estimate the megawattage produced if this percentage changed denials. Three articles were used to assess the impact of local ordinances on the ability to develop solar. Extrapolating these estimates to reduce developers' ability to site within an area, we can calculate how much megawattage would be generated if these restrictions do not contribute to the denials.

The first study used is a preprint by Owusu-Obeng, Mills, & Craig in 2024 from the University of Michigan-Ann Arbor, which estimated that the impact of zoning ordinances on land available for solar to be 13% decrease if done so using a restricting siting based on agricultural zones and a 52% decrease if regulations prevent solar entirely. The methodology of this paper was to isolate available land by applying current zoning ordinances and land use exclusions to individual land parcels throughout the study region, then create a capacity expansion model to estimate the most feasible and cost-efficient sites for construction. Then, they calculated the land availability of solar energy through different regulation scenarios to estimate the decrease when different zoning regimes were applied (Owusu-Obeng, 2024). Both of their reduction calculations were added to my scenario calculations.

The second study used is by Lopez et al., published in 2023 in *Nature Energy*, which focused specifically on the impact of setback ordinances on wind and solar capacity availability. First, they generated a nationwide catalog of restrictive setback ordinances. These were used to calculate the 25th, 50th, 75th, and 90th percentiles for all zoning setbacks for wind and solar. Then, they created a nationwide model for the no setbacks (used as the baseline), 50th percentile, and 90th percentile scenarios. This was done using spatial modeling through the NREL's Renewable Energy Potential model. Finally, they calculated land availability based on these scenarios. For solar, the 50th percentile scenario resulted in an 18% reduction in land availability, with the 90th percentile yielding a 38% reduction (Lopez et al., 2023). These are the points in my scenario calculations.

The third study used is by Lopez et al., published in 2024 by the NREL. This study focuses on evaluating the technical potential of solar and wind in the contiguous United States. They first created three different siting regimes to account for various levels of restrictive ordinances, designated as open, reference, and limited. In their evaluation, they also account for transmission constraints and resource availability and make technological or financial assumptions. Using this, they calculate the developable area, total capacity, and total potential generation for the contiguous United States and each state. The values used in this analysis come from the Virginia data, with the open scenario compared to the reference scenario (66% reduction) and limited scenario (88% reduction).

The average of these scenarios is 2,661.93 MW.

<u>Section 2.2: Alternative 2</u>

We must aggregate the effects of technical assistance programs to estimate the effectiveness of improving connections between receptive localities and solar developers.

As Washington State's least-conflict siting strategy is the main impetus for this alternative, the perceived outcome of this program will serve as the starting point in evaluating effectiveness. Before the 2023 implementation, Washington had five operating utility-scale solar plants developed between 2018 and 2022 for 189MW. In 2024, the Appaloosa solar facility was a nnounced, with a 142 MW capacity (Thomas, 2025; Puget Sound Energy, 2024).

This suggests that technical assistance could provide a 75.13% increase in MW approval, which will be considered the upper bound of impact possible from technical assistance alone. In addition, six counties requested grants specifically for feasibility studies on large-scale solar, indicating an interest in development. As Washington has 39 counties total, this represents an uptake of 15.38%.

Another uptake measurement can be extrapolated from the IRS's Opportunity Zones program, which sought to connect low-income neighborhoods with investment. Only 48% of eligible opportunity zones saw investment resulting from the program by 2020 (3 years after implementation), indicating the technical assistance provided was moderately effective at connecting investors with communities.

Another federal example of impact comes from a 2020 Department of Housing and Urban Development study on occupancy rates following the implementation of the technical assistance program Community Compass. The study saw increases from the "low 70s to 95 percent" and "below 80 percent to 98 percent." These were roughly translated to impact percentages of 31.94% and 25.64%, respectively.

These indicate a positive association of technical assistance with project outcomes but with widely varying degrees of uptake and effectiveness.

Two measurements are needed to estimate the effectiveness: uptake and impact. The uptake estimation is between 15.38% and 48%. When impact is converted to percentages through percentage change, this range becomes 25.64% to 75.13%. These are multiplied to get the final percentage improvement over the calculated baseline for this alternative. Four possible scenarios (3.94%, 11.55%, 12.31%, and 36.06%) are projected from the worst case, best case, and two intermediate estimations, which are then aggregated for a final estimated 1,964.49 MW.

<u>Section 2.3: Alternative 3</u>

To calculate the effectiveness of improved community engagement practices, we must understand the effect that the public's perception of their involvement has on the success of a project. In a survey of 123 solar developers, Nilson et al. asked about projects that had been canceled, delayed, or successful. Then, they asked whether the public was aware of the project, solely kept informed, provided input, allowed to recommend decisions, or made decisions. When aggregated, the percentage increase from projects canceled/delayed to success when accounting for public input was 37.93%. The percentage increase in projects being successful in keeping the public informed is a moderate 5% (Nilson et al., 2024b). These are the two numbers used to estimate the effectiveness of this alternative, which becomes 2,092.89 MW when averaged.

Section 2.4: Alternative 4

This alternative is the easiest to measure for the status quo, as we expect that present trends continue without intervention. To do so, I started with my trends over time for megawattage approved, see Table 1.

Year	Approved MW	Denied MW	Withdrawn MW	MW Denied or Withdrawn	Total MW	% MW Denied or Withdrawn	% MW Approved
2013	1.7	0	0	0	1.7	0.00%	100%
2014	2.45	0	0	0	2.45	0.00%	100.00%
2015	178.5	0	0	0	178.5	0.00%	100.00%
2016	347.6	20	0	20	367.6	5.44%	94.56%
2017	624	35	44	79	703	11.24%	88.76%
2018	1758.2	78	35	113	1871.2	6.04%	93.96%
2019	1385	290	219.9	509.9	1894.9	26.91%	73.09%
2020	1592	195.8	410.4	606.2	2198.2	27.58%	72.42%
2021	1480.48	371	106	477	1957.48	24.37%	75.63%
2022	2937.4	520.25	265.9	786.15	3723.55	21.11%	78.89%
2023	1705.65	598.75	270	868.75	2574.4	33.75%	66.25%
2024	1007.3	934.98	932	1866.98	2874.28	64.95%	35.05%

Table 1: Megawattage Applied for by Year and Status
Source: Virginia Solar Initiative, 2024

Trends suggest that the total MW applied for will continue to rise modestly, remaining between 2,500 MW and 3,500 MW. Gauging approvals is more complex, but the approval rating has significantly declined from 2018 to 2024. The rise in restrictive local ordinances began to emerge in 2023. We need to develop a range of approval scenarios for the current state to account for multiple possibilities. The baseline total application number of 2,335.21 MW will be evaluated through potential approval percentages.

Ladder:

- Approvals increase to 70.76% (average approval % over the period 2018-2024)
- Approvals increase to 60%
- Approvals increase to 50%
- Approvals increase to 40%
- Approvals decrease to 30.52% (average % change over the period 2018-2024 applied to 2024 level)
- Approvals decrease to 18.54% (% change from 2023-2024)
- Approvals decrease to 15% (to account for present trends worsening to a 57.20% change)

Omitting the worst and best cases, the average megawattage approved in these scenarios is 929.69 MW, which is the final expected outcome letting present trends continue.

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