Solar Climate Justice Scorecard

Beta Version
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COMMUNITY CLIMATE
COLLABORATIVE

Solar Climate Justice Scorecard

Methodology Guide

Executive Summary

The climate crisis demands a rapid and just transition away from the fossil-fuel resources that have fueled our economy for over a century. One key piece of this transition will include the increased deployment of solar energy at various scales. The Community Climate Collaborative (C3) created the Solar Climate Justice Scorecard to assess such proposed solar projects in Virginia and across the U.S. The scorecard analyzes a solar project's performance across four key climate justice areas: (i) Procedural Justice, (ii) Distributional Justice, (iii) Restorative Justice, and (iv) Other Socio-Economic and Environmental Factors. Our hope is that this tool can be used by other climate and social justice advocates to conduct independent analyses of solar projects and more effectively advocate for renewable energy solutions.[i]

i This is the Beta version of the Solar Climate Justice Scorecard. We encourage interested parties to reach out with comments and suggestions at policy@theclimatecollaborative.org so we can continue to improve this open-source and community-built tool.

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Introduction

An important component of the fight against the climate crisis will be to transition away from fossil fuels and toward renewable energy. For instance, one of the primary forms of renewable energy generation in Virginia is solar energy and it is likely to remain the case. According to the Solar Energy Industries Association, the Commonwealth is ranked in the top 10 states in the U.S. in terms of expected solar growth in the next five years, projected to deploy 5,977 MW of solar energy by 2027. [1]

As we move to a clean energy future, it is imperative that we avoid replicating the same power dynamics and pollution of our traditional energy production. It has historically been the case that lower-income households and communities of color have been and continue to be forced to bear disproportionate harms of energy production without due consent or benefits. According to environmental justice principles, counteracting those harms requires advancing procedural, distributive, and restorative justice. At the same time, it is imperative to rapidly deploy clean energy in order to mitigate the climate crisis. There is, therefore, a clear need to be able to quickly and consistently assess newly proposed solar projects to identify those that might be counterproductive to climate justice principles and those that are more likely to align with the urgency and care called for by the climate justice movement.

As we move to a clean energy future, it is imperative that we avoid replicating the same power dynamics and pollution of our historic energy production.

We have set out to craft a comprehensive scoring tool for assessing non-residential on- and off-site solar photovoltaic (PV) projects with the goal of both streamlining evaluation processes and creating comparable and consistent criteria for future assessments. Our intention is not to slow the progress of clean energy developments across the United States, but rather to expedite their just and efficient deployment. The analysis considers elements in four main climate justice areas: (i) Procedural Justice, (ii) Distributional Justice, (iii) Restorative Justice, and (iv) Other Socio-Economic and Environmental Factors. Each topic is weighted according to its importance to this analysis.

What Type of Project Can This Be Used For?

This tool can be used for non-residential on- and off-site PV solar projects in the United States. We define on-site projects as those where solar panels are installed adjacent to the building that would benefit from their energy generation.[2] An example of an on-site project would be adding solar to a school's roof, lawn, or parking and using the generated energy to alleviate/reduce the school's energy bill. An off-site project is one where the beneficiary organization and the solar energy project are in distinct locations. Given the differences between the two types of projects, there are two "tracks" that projects can take in this analysis. The highest score that a project can receive is 50.

If there is an on-site project that has many of the same characteristics as an off-site project, we recommend modifying the scorecard to accommodate these nuances. For instance, if a data center plans to add a large array of ground-mount solar infields within the data center's main property site, it might be appropriate to apply some of the questions from the off-site scorecard.

How Do We Use the Tool?

Each topic has a set of scoring questions. Use the methods and links provided at the end of the document to answer the scoring questions. Calculate the scores for the developer, project type, and external factors questions to generate the project's score. We recommend reporting both the developer's score and the total score for each project.[ii]

The Solar Climate Justice Scorecard (referred to interchangeably throughout the report as "the tool") is intended to help understand how well a proposed solar PV project aligns with best practices in climate justice, climate change mitigation, community economic wellbeing, and human and environmental health.

This tool is not meant to quantitatively assess the performance of a particular solar developer but rather to understand how well a project as a whole aligns with the principles of environmental justice and other equity values. In that sense, there is a role municipalities play in any project to ensure that it best fits the need of their constituents. Therefore, the community/municipality chosen to host the project should also be a part of the assessment.

The scoring questions are first divided into three categories:

1. Questions that are under the control of the developer and are applicable to both on-site and off-site projects;
2. Questions that are under the control of the developer but depend on whether the project is on-site or off-site;
3. Questions whose scoring is external to the developer's decision.

The score categories are subdivided into sections that are weighted based on their importance. When combined, all categories offer a total of 50 points. The final score is then converted to a percentage. To accommodate the role that the developer and other outside forces play in any solar project, we recommend using two different final scores: a score that solely captures the developer's performance (focusing on topics that are within the control of the developer) and a total score that captures the overall project's performance (also encompassing the regulatory, environmental, social, and governmental contexts of the project).

ii Please contact us at the Community Climate Collaborative (policy@theclimatecollaborative.org) for ensuring consistency across different assessments before releasing your score.

Summary Tables of Overall Project Score

Developer's Score -- General

Topic	Potential Score	Actual Score
Procedural Justice	5	
Distributional Justice	5	
Restorative Justice	5	
Other Socio-Economic and Environmental Factors	10	
Subtotal	**25**	

Developer's Score -- Type Specific

Off-Site Project

Topic	Potential Score	Actual Score
Other Socio-Economic & Environmental Factors	10	
Subtotal	**10**	

On-Site Project

Topic	Potential Score	Actual Score
Other Socio-Economic & Environmental Factors	10	
Subtotal	**10**	

External Score

Topic	Potential Score	Actual Score
Procedural Justice	3	
Restorative Justice	3	
Other Socio-Economic & Environmental Factors	9	
Subtotal	**15**	
Total	**50**	

What Does My Score Mean?

The goal of our scorecard is to compare different projects and identify the strengths and weaknesses of each project.[iii] A low score on this assessment does not necessarily indicate that a project should not be supported.

We believe that the scoring criteria of this tool allow for the nuances of projects to be better highlighted than in scores that generously give all assessed projects grades between 90%-100%. This strategy is consistent with other, similar scorecards, that score very few projects in the top 80% of possible points. For instance, in the ACEEE scorecard for energy-efficient states, only two states score more than 39 points, out of 50 (or 78%).[3] Similarly, in the ACEEE energy scorecard for municipalities, the highest-scoring city, San Francisco, only earned 74 out of 100 possible points (or 74%).[4]

What Are The Limitations Of This Tool?

The environmental impacts of a solar project can be divided into the construction, operation, and decommissioning phases.[5] There are aspects of the construction and decommissioning phases that fall beyond the scope of this tool. For instance, in the case of construction, there is a concern that grading sites can degrade high-quality soils and could therefore be counterproductive from an environmental perspective. C3 recognizes the importance and complementarity of such environmental impact studies and recommends assessing them in conjunction with the results of this scorecard.

iii Overtime as more projects are analyzed and more feedback is received, C3 hopes to create a more clear rule for qualitatively assessing projects.

Potential Score

25

Actual Score

The Scorecard

Developer's Score - General

Solar siting decisions, made by the developer, have the potential to advance climate justice through their impacts on Procedural Justice, Distributional Justice, Restorative Justice, and Other Socio-Economic and Environmental Factors. By presenting a series of quantitative and qualitative questions for each area, this category will analyze topics that are under the control of the developer and are applicable to both on-site and off-site projects.

The "Developer's Score - General" category is worth a total of 25 points in the scorecard. The Procedural Justice, Distributional Justice, and Restorative Justice subcategories are each worth five points. The Other Socio-Economic and Environmental Factors subcategory is worth 10 points.

Procedural Justice [6] [7] [8]

Procedural justice is concerned with the extent to which the public is informed, engaged, and listened to in environmental decision-making. In the case of solar development, developers should seek the input of local communities, especially demographics and groups that are typically excluded from the decision-making process, and incorporate their desires into the final siting and operating decisions.

(...) all prospective stakeholders ought to be well-informed in a culturally and linguistically appropriate manner.

This section asks a series of "yes-no" questions that make it straightforward and impartial to assess how well a project is supported and informed by the community. There are four questions to measure the effectiveness of the developer to elicit participation, and one question to assess external factors of the project. These questions draw on existing best practices. [9] [10]

Determining Stakeholder Engagment

The identification of relevant stakeholders for any development project is fluid, broad, and subjective. In some cases, it comes down to who cares deeply about something and feels (positively or negatively) impacted by it. With that in mind, C3 recommends starting with a broader understanding of "potential stakeholders", particularly for major projects, and informing them sufficiently well so that they can have a chance to self-identify as stakeholders.

For instance, it may be true that in the properties surrounding a proposed solar array, the vast majority of the population speaks English as their first language. However, given that there might be potential stakeholders beyond just the surrounding properties, all prospective stakeholders ought to be well-informed in a culturally and linguistically appropriate manner.

On Stakeholder Engagement

Understandably, there is hesitancy around compensation for engaged community members, especially if that compensation is from the developer. With that said, compensating community members for their expertise is an emerging best practice in environmental and planning work, and it can be effective for soliciting feedback from underrepresented groups. [11]

We removed the expectation of compensation from the developer and placed it more broadly on the whole ecosystem of a project. Our analysis accepts a wide range of possible types of compensation, from providing childcare services and refreshments at community meetings to giving financial compensation. The Energy Equity Project (EEP) collective similarly outlines best practices for supporting community engagement as part of procedural justice, and it posits that local governments can be one source of these engagement incentives. [12]

We recognize that the status quo does not place the burden of compensating community members on the developer, and we, therefore, chose to have this question count toward the overall project score and not toward the developer's score.

Procedural Justice Scorecard (5 points)

ID	Question	Scores		
PJ1	**How successful was the community engagement process?**	**Points** (0 = No 1 = Yes)	**Score Multiplier**	**Score** (Multiplier x Points)
PJ1.1	Were there multiple meetings/forms of engagement?		1.25	
PJ1.2	Were materials available in multiple and appropriate languages?		1.25	
PJ1.3	Were meetings held at various times and/or in different media to accommodate different work schedules/accessibilities?		1.25	
PJ1.4	Were changes sourced from the community implemented in the final project?		1.25	
	Subtotal (0-5)			

Distributional Justice [13] [14] [15]

Distributive justice considers how the harms and benefits of this project are felt throughout the community to ensure that no group is overburdened with the negative impacts. Historically, negative impacts of the fossil-fuel industry –both at the point of extraction, transmission, consumption, and power generation– have been concentrated in communities of color and lower-income communities (often referred to as "environmental justice communities of concern", or EJCOC).[16]

An increased presence of solar developments can, therefore, inherently prevent violations of distributional justice by prompting the closure of existing (and deter the investment in new) dirty fossil-fuel infrastructure (e.g., drilling rigs, pipelines, compressor stations, power plants, etc.). However, to ensure that past and present injustices are not manifested in new ways, solar projects must mitigate potential harm from their construction and operation.

The negative local distributive justice impacts of a project might include noise, traffic, and air and water pollution from construction. Positive impacts include climate change mitigation, the generation of increased tax revenue, the potential closure of existing fossil fuel power plants, and workforce opportunities. Several of these benefits are also discussed in other sections of this analysis. To the extent that any harm or benefit can be distributed unevenly across a community, it was included in this section.

Distributional Justice Scorecard (5 points)

ID	Question	Scores		
DJ1	**Are the impacts of the project equitably distributed across the community?**	**Points** (0 = No 1 = Yes)	**Score Multiplier**	**Score** (Multiplier x Points)
DJ1.1	Does the project aims to prioritize local and/or displaced workforce?		1	
DJ1.2	Does the project benefit the local community through improved economic and/or environmental conditions?		1	
DJ1.3	Does the project benefit traditional EJCOC through improved environmental conditions?		1	
DJ2.1	Are the negative impacts of the project expected to be distributed in a way that no one group is disproportionally exposed to them?		1	
DJ2.2	Are there substantial attempts made to mitigate the local negative impacts in all phases of the project?		1	
	Subtotal (0-5)			

Restorative Justice

Some of the ways that the traditional fossil fuel-powered electricity system has degraded human health and well-being include: polluting the environment, inducing climate change, and contributing to financial energy burdens. Renewable projects have the potential to correct those historic harms by redistributing benefits to those who have been disadvantaged and closing fossil fuel-powered power plants, which have historically been located in lower-income communities and communities of color.

The benefits of renewable energy projects can be redistributed to communities historically harmed by the fossil fuel industry in the form of monetary benefits, increased job opportunities, and improved environmental/health conditions. This restorative justice focuses on the potential monetary and environmental improvements to the local community.

Restorative Justice Scorecard (5 points)

ID	Question	Scores		
RJ1	**Financial compensation for families historically impacted by bad air quality and/or high energy burdens?**	**Points** (0 = No 1 = Yes)	**Score Multiplier**	**Score** (Multiplier x Score)
RJ1.1	Does the project create low- or no-cost job re-training for renewable energy jobs?		1	
RJ1.2	Does the project have the potential to close existing fossil fuel-powered power plants?		2	
RJ1.3	Does the project site remedy historic environmental injustices?		1	
	Subtotal (0-5)			

Other Socio-Economic and Environmental Factors

Broadly, the use of renewable energy to rapidly transition away from fossil fuels is necessary for global climate and environmental wellbeing. In the process of actualizing that goal, it's possible that local ecosystems are negatively impacted. Potential environmental harms include light and noise pollution, visibility, electromagnetic radiation, heat islands, vegetative removal, interference with species, vehicular activity, environmental toxicants, addition/removal of equipment, grading, panel washing, and erosion.[17] The use of land for solar or any other extractive purpose is almost inherently guaranteed to cause environmental harm compared to a natural ecosystem would.

(...) a project's proximity to existing transmission lines could obviate the need for clearing land to connect the project to the grid.

The environmental health questions of this subcategory are scored therefore based on how the solar development in question improves or degrades the environment of the site based on the existing or otherwise expected use. Conventional wisdom is that solar on a brownfield or other damaged site would be preferable to greenfield development.[18] While, provided that all else is equal, that is likely true, this conclusion might change if we consider the impacts beyond the solar farm site itself. For example, a project's proximity to existing transmission lines could obviate the need for clearing land to connect the project to the grid. In this case, such site choice could be as beneficial, if not more beneficial, to develop for solar power as a brownfield or former mine site would be.

There are several ways to break down the human and environmental health impacts of a solar PV project. This analysis divides harms along the typical temporal phases of solar PV projects: construction and operation. Because the impacts of each phase are so distinct, it's convenient to divide the analysis into units of time to analyze a project. We then weighed the damage occurring in each phase by the length of time that the damage will last. The construction phase uses a weighted factor (called "score multiplier" here) of 1. The operational phase is weighed by a factor of 2 as it is most heavily because it's the longest phase.

For the economic questions, we considered three factors: jobs, rates, and taxes. The three qualitative economic questions are primarily concerned with the overall change in local economic conditions rather than the distribution of the changes (see Distributional Justice Scorecard for this analysis). Each economic question is worth a total of 2 points.

In total, the Other Socio-Economic and Environmental Factors questions are worth 10 points.

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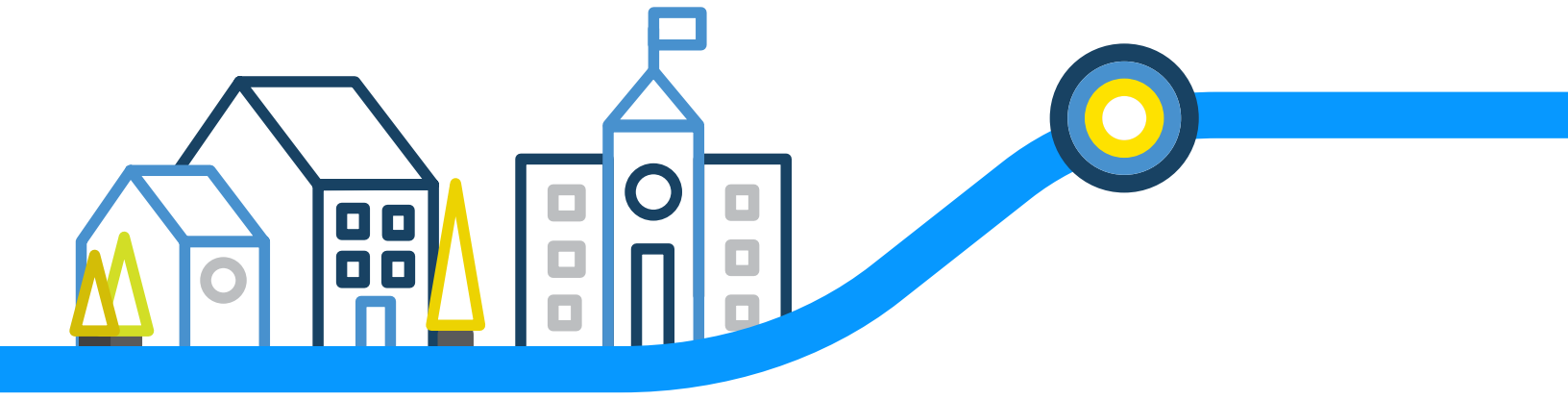
Other Socio-Economic and Environmental Factors Scorecard (10 points)

Human and Environmental Health Questions				
ID	**Question**	**Scores**		
SE1	**Environmental impact mitigation**	**Points** (0 = No 1 = Yes)	**Score Multiplier**	**Score** (Multiplier x Score)
SE1.1	Is the project in a site that is already well-served by transmission lines, substations, roads, etc. so that major infrastructure investments can be prevented or mitigated?		2	
SE1.2	Does the project present strong strategies to mitigate/prevent major soil, vegetation, and wildlife disturbances?		2	
Economic Questions				
SE2	**Overall economic stimulus to the surrounding community**	**Points** (0 = No 1 = Yes)	**Score Multipler**	**Score** (Multiplier x Score)
SE2.1	Will the project create temporary jobs?		2	
SE2.2	Will the project create permanent jobs?		2	
SE2.3	Will the project reduce local energy burden?		2	
	Subtotal (0-10)			



Potential Score

10

Actual Score

Developer's Score - Type Specific

The questions in this category address the aspects of the solar development that are specific to whether the project is on-site or off-site. The questions in this section still fit within the topics of "Restorative Justice" or "Other Socio-Economic and Environmental Factors," although the question IDs are related to the type of project rather than the topic of the question.

Off-Site Considerations

The off-site questions pertain only to the "Other Socio-Economic and Environmental Factors" topic. One concern with large, off-site solar projects is that they have the potential to degrade existing habitats if the development is irresponsibly sited or constructed. Questions OF1.1 through OF1.4 address the discrete, environmental considerations of a solar project, including (i) biodiversity, (ii) soil health, (iii) water quality, and (iv) heat-island effects. These four questions are binary such that when a project has a positive environmental impact, it should get a full one per question. The point value for the first four questions in this section is multiplied by 1.25.

Question OF2.1 addresses the climate change mitigation potential of a project. The highest score that a developer can achieve for this question is five, and a project recieves a higher score for increased mitigation potential. For off-site projects, the scorecard assesses the mitigation performance based on the equivalent number of homes that could be powered by the project's expected annual generation (check the "How to Conduct the Analysis" section for detailed instructions). In total, the "Off-Site Considerations" category is worth 10 points.

Off-Site Scorecard (10 points)

ID	Question	Scores		
	Binary Questions	**Points** (0 = No 1 = Yes)	**Score Multiplier**	**Score** (Multiplier x Score)
OF1.1	Will biodiversity be overall improved?		1.25	
OF1.2	Will soil quality be overall improved?		1.25	
OF1.3	Will water quality be overall improved?		1.25	
OF1.4	Has the project been designed in a way to prevent potential negative impacts from the heat generated by the solar panels?		1.25	
	Range Question	**Points** (0—5)	**Score Multiplier**	**Score** (Multiplier x Score)
OF2.1	Will the solar project contribute to substantial climate change mitigation?		1	

Subtotal (0-10)

On-Site Considerations

The on-site questions pertain both to the "Restorative Justice" and "Other Socio-Economic and Environmental Factors" topics. The first two questions (each worth 2.5 points) address two different types of climate resiliency considerations that a project can use. The third question (ON2.1) is worth five points and assesses the climate change mitigation potential of a project. For on-site projects, the scorecard assesses the mitigation performance based on how much of the site's baseline energy consumption could be offset by the solar panels (check the "How to Conduct the Analysis" section for detailed instructions). In total, the "On-Site Considerations" category is worth 10 points.

On-Site Scorecard (10 points)

ID	Question	Scores		
	Binary Questions	**Points** (0 = No 1 = Yes)	**Score Multiplier**	**Score** (Multiplier x Score)
ON1.1	Does the project enable increased power supply resiliency through the addition of energy storage systems? [17]		2.5	
ON1.2	Does the project enable increased power supply resiliency through the creation of a microgrid?		2.5	
	Range Question	**Points** (0—5)	**Score Multiplier**	**Score** (Multiplier x Score)
ON2.1	Will the solar project contribute to substantial climate change mitigation?		1	
		Subtotal (0-10)		

Potential Score

15

Actual Score

External Factors

The questions in this category address the aspects of solar projects that fall outside of the developer's control. The City or County where a solar development is located can play a big role in how well a project is able to meet the best climate action practices. For instance, some localities might have innovative tax structures in which tax revenue from solar projects goes toward advancing climate justice goals (e.g., reducing the community's energy burden). The external factor questions fit into three topics: Procedural Justice, Restorative Justice, and Other Socio-Economic and Environmental Factors.

Different weights are assigned to questions based on their relative importance to the overall score. Questions EF1.1 – EF1.4 are binary questions, and question EF2.1 is a range from 0-2. The total for the External Factor Category is 15 points.

External Factors Scorecard (15 points)

ID	Question	Scores		
	Binary Questions	**Points** (0 = No 1 = Yes)	**Score Multiplier**	**Score** (Multiplier x Score)
EF1.1	Were attendants compensated? (monetarily and/or with food/childcare)		3	
EF1.2	Will generated tax revenue be allocated toward advancing climate and environmental justice?		3	
EF1.3	Will the avoided greenhouse gasses (GHG) emissions directly contribute to local climate change mitigation goals?		2	
EF1.4	Will the decision of approval or rejection of this project set an important precedent that could significantly influence future solar projects?		3	
	Range Question	**Points** (0—2)	**Score Multiplier**	**Score** (Multiplier x Score)
EF2.1	Will the use of solar on the landscape decrease local tax revenue (0), cause no change (1), or increase tax revenue (2)?		2	
		Subtotal (0-15)		

How to Conduct the Analysis

Developer's Score - General

Procedural Justice

The overarching goal in the Procedural Justice questions is to capture "how well-managed was the community engagement process?" According to state code, the specifics of solar energy siting are largely left to localities.[19] Therefore, depending on the kind of project and the specific locality where it is proposed, there will be different rules for community engagement.

This step [Step Two] ultimately seeks to assess the level and accessibility of engagement as well as the extent to which community feedback was incorporated into the final design and planning.

Step One: Understand The Local Regulatory Environment

In Virginia, for instance, solar arrays are subject to review by a locality's comprehensive plan with a few exceptions: (i) the generation is of a small scale and/or the energy is to be used on-site, (ii) a locality has established by-right zoning designations for solar, or (iii) a locality has waived certain review requirements.[20] There may be other nuances in addition to the three aforementioned, such as those related to entrance corridors and historic districts, which raises the necessity of checking the local regulations that a specific project will be subjected to. For instance, in Albemarle County, Virginia, solar energy systems must be granted a special-use permit, which includes a public hearing process and certain community engagement requirements.

An important first step to assessing procedural justice is to understand the local regulatory requirements of a solar project in the locality you study. However, the Procedural Justice section of this framework seeks to understand how well a developer engages in best practices related to community engagement. To assess the success of community engagement in the planning process and answer the overarching question of "how successful was the community engagement process?" there are five binary sub-questions. These sub-questions were informed by best practices in community engagement.[21]

Step Two: Assess The Level Of Engagement

This step ultimately seeks to assess the level and accessibility of engagement as well as the extent to which community feedback was incorporated into the final design and planning. Information for the procedural justice scorecard can be sourced from conversations with community members, the solar developer, and local officials.

Distributive Justice

In siting solar PV projects, especially greenfield projects, there is a concern that historic inequalities are being repeated. The concern is in great part that rural, and potentially lower-income, communities will be forced to bear the burdens of new energy generation sites that are mainly powering urban centers. The distributive justice questions are divided into two areas: potential benefits of the project and potential harms of the project. The idea is to assess how well the impacts of a project are distributed throughout a community, not the size of the impact itself.

Step One: Understand the existing environmental hazards and socioeconomic characteristics of an area

To understand the existing exposures to a community where a solar project is proposed, we recommend using the EPA's EJScreen.[22] Projects proposed in areas with high levels of pollution or low socioeconomic conditions should have additional consideration to avoid compounding harm.

Step Two: Understand potential harms

As the environmental harms of a project are largely covered in the Other Socio-Economic and Environmental Factors questions of this scorecard, the distributional questions are mostly targeting how well a developer mitigates potential imbalances in the distribution of the benefits and harms associated with the project. Specific harms might vary based on what is of importance to local community members. Information to answer these questions can be sourced from permit applications, site management plans, and other documents.

Restorative Justice

Restorative justice questions were largely sourced from existing energy justice scorecards. To answer the questions, information can be found in permit applications, management plans, and conversations with the developer or local community groups.

Other Socio-Economic and Environmental Factors

Solar deployment has the potential for increasing local employment and tax revenue. To understand the extent to which that is the case for any particular project, we created five questions that get into some of the nuances of the expected employment and overall economic impact.

SE 2.1 Will the project create temporary jobs?

Use "The projected economic stimulus from temporary job creation" table, below, to calculate the number of temporary jobs and associated wages created by a project. The footnotes in the table explain where to source data.

Projected Economic Stimulus From Temporary Job Creation	
(J) direct, temporary construction jobs created[v]	
(K) associated labor income from the temporary construction jobs ($)[23]	
(L) total wages from direct jobs during the construction period: (L) = (J x K)	
(M) indirect jobs for the period of construction[vi]	
(N) total direct and indirect jobs during the construction phase (J + M)	

SE 2.2 Will the project create permanent jobs?
To answer this question, it is important to know how many people are currently employed on the land. For instance, it may be that the project is proposed on the roof of a shopping mall where there would be few to no displaced jobs. It can be challenging to determine the net change in direct, permanent jobs as a result of one solar project. We recommend asking the specific developer and corroborating estimates with reports from similar projects.

SE 2.3 Will the project reduce local energy burdens?
There are several possible ways for solar projects to contribute directly to energy justice, including but not limited to, providing low-cost options to lower-income communities. This question does not have associated calculations, and can instead be answered by understanding where the power from a project will go by asking local officials or the developer.

v According to calculations made by FreeingEnergy, using data from the Solar Foundation and SEIA, there are 2.1 jobs created for every 1MW of utility-scale solar, and 19.1 jobs created for every 1MW of commercial-scale solar.

vi See table of induced jobs based on industry at Bivens, J. 2019. Updated employment multipliers for the U.S. Economy. Economic Policy Institute. Accessed on 09 Dec 2022 by https://www.epi.org/publication/updated-employment-multipliers-for-the-u-s-economy/

Developer's Score - Type Specific

Off-Site Questions

OF 1.1–1.4 Environmental impacts to a site

The majority of the environmental and health concerns of projects were related to off-site projects where land might be cleared or graded in order to add solar. A short literature search was conducted to determine the common human and environmental health concerns with off-site PV arrays. Where there are harms related to the site in question, vegetation and site management plans can be helpful in understanding the extent of damage and the potential for mitigation.

OF 2.1 Will the solar project contribute to substantial climate change mitigation?

This analysis measures how well a home contributes to climate change mitigation by quantifying how many homes are powered by an off-site project. Follow the steps below to determine how many homes could be powered by the project and how that translates to a score for this analysis.

Step One: Estimate how many homes will be powered by a solar project

How Many Homes Could Be Powered By The Project?	
Electricity generated (in MWh)	
Average household energy consumption, EIA 2021 (MWh/year)[24]	13.13078
Homes powered (HP)	

Step Two: Convert the homes powered into a score for the scorecard in the "Off-Site Scorecard"

The table below, "Off-Site GHG Mitigation Scoring Guide" explains how to score a project for question OF2.1 based off of how many homes are powered by an off-site solar development.

Off-Site GHG Mitigation Scoring Guide

Number of Homes Powered	Score
≤ 100	0
101—5000	1
5001—10,000	2
10,001—25,000	3
25,001—50,000	4
> 50,000	5

Additional (Optional) Analysis

There are several stages of PV solar development that can contribute to emitting and/or avoiding GHG emissions. Most prominently are the embodied emissions from the panels' manufacturing and those emissions associated with land-use changes (including those that occur due to soil disturbances during the construction or landscaping maintenance to keep vegetation from blocking the panels).[vii]

While these nuances are not directly considered in the Beta version of the Solar Climate Justice Scorecard, we recognize that they may be of interest to many of the scorecard users. Currently, the scorecard questions that indirectly relate to the baseline GHG emissions of a project are OF 2.1 and SE 1.1 (which recognizes the importance of having projects near transmission lines in order to reduce deforestation).

To better understand how your project contributes to climate change, please use the steps below to calculate the GHG emissions avoided in the first year and/or calculate the GHG emissions released from a project. The project's net emissions reductions can be calculated by subtracting the project's generated emissions from its avoided emissions.

vii There are several strategies to reduce emissions from landscaping, including grazing (see: Lenaghan, M. A. 2016. Sheep grazing in "lawnscape" management: an emissions comparison with conventional "lawnscape" management. Landscape Research: 41, 838–852. Accessed on 05 Dec 2022 by https://www.tandfonline.com/doi/abs/10.1080/01426397.2016.1234033).

Step One: Calculate the energy generated by a site

If not provided by the developer, use the following methodology (sourced from the literature and industry experts) for calculating the expected energy generated by a project. Follow the tables in the order below to calculate estimated energy generation. Footnotes detail where to source each number:

How Much Electricity Will be Generated From This Site In One Year (in MWh)?[viii]	
MW AC (either given or can estimate using 1MW per 10-12 acres)[ix]	
MWp (MW-AC * DC-AC conversion factor of 1.3)[x]	
Expected PVCF[xi]	0.25
Electricity (Mwh) generated [MWp * PVCF * 8736][25]	

Step Two: Calculate emissions avoided in Year One

The analysis here considers only the GHG emissions reduced from the first year of energy generation. Given the uncertainty of the pace that we decarbonize our grid, predicting emissions reductions in future years can be difficult. For instance, if we assume that grid emissions factors remain the same overall for the lifetime of the project, this estimate will apply to every year for 30+ years. However, if the grid is rapidly decarbonized, the capacity to offset/avoid emissions from one specific project will be dampened (given that its additionality is minimal). Ultimately, given the lack of certainty in future emissions, we recommend only calculating emissions avoided for the first year.

GHG Emissions Were Avoided By The Project In The First Year	
(A) Projected annual energy generation (see calculations in table 1) (MWh/year)	
(B) Virginia output emission rates, eGRID2020 (CO_2e lb/MWh)[xii]	644.8
GHG avoided in Year 1 ((A) x (B) / 2000) (in US tons)	

viii There are several ways to calculate the MWh created in a year. Another option is to use the "specific yield" of a project.

ix The MW-AC or MW-DC will often be provided in literature for the solar site. If the number is not provided (or you want to double-check the numbers provided), you can calculate a rough MW-DC estimate by assuming 1 MW per 10-12 acres for Virginia sites. That estimate includes the setbacks, roads, wetlands, etc

x The DC-AC Conversion Factor converts from MW-AC to MWp. This accounts for the difference in peak energy created and the amount that goes to the grid.

xi The PVCF stands for the PV Capacity Factor. While similarly named to the above number, it represents the percentage of energy generated from throughout the year by accounting for things like shade, cloudy days, etc. Energy Information Administration [EIA], 2021. Electric power monthly: Capacity factors for utility scale generators primarily using non-foissl fuels. Accessed on 09 Dec 2022 by https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_b.

xii It's important to observe that the "lbs/MWh" factor is frequently changing as our region's grid gets cleaner. Particularly, in view of the Virginia Clean Economy Ac (VCEA), this factor is expected to approach "zero" over the next decades, potentially reducing the climate change mitigation benefits of inidividual clean energy power plants.

Step Three: Calculate the GHG emitted from embodied carbon

The embodied carbon in the panels is estimated in the table below. Information on embodied carbon in Crystalline Silicon PV cells was sourced from the National Renewable Energy Lab (NREL). Different panel materials have varying amounts of embodied carbon. C3 used the data for Crystalline Silicon PV panels because they are the most common kind of panel used

GHG Emissions From PV Panel Manufacturing	
(A) GHG emissions from manufacturing (g per kWh)[26]	49
(B) Number of grams in one ton	907,184
(C) Number of kWh in one MWh	1,000
(D) *GHG emissions from manufacturing (tons per MWh)*	0.54
(E) Energy generated from the site (MWh)	
GHG emitted from manufacturing PV panels for the site: (D) x (E) =	

Step Four: Calculate the GHG emitted from land use changes

There are two types of land–use change that we considered in this calculation, and both are primarily related to off-site energy generation. The first is the change in land use of the site itself. Based on the existing ecosystem, adding solar to a site might negatively impact the natural carbon sequestration process more or less. The second change we considered was the land use change associated with transmission lines. For instance, if a project is far from an existing grid connection, and several miles of forested land must be cleared to connect the project, it may be less favorable, from a carbon and ecosystem perspective, than a project that is located next an existing connection point. C3's analysis includes emissions from manufacturing and deforesting existing pine stands.

Step Five: Compare the GHG emitted to the GHG avoided to determine how successfully a project mitigates climate change.

The GHG avoided is calculated for the first year of the project. As the project ages, and more and more of the grid is replaced by renewables, the emissions avoided will shrink. Given the uncertainty in the future grid mix, we only calculate for one year of energy generation.

37 According to calculations made by FreeingEnergy, using data from the Solar Foundation and SEIA, there are 2.1 jobs created for every 1MW of utility-scale solar, and 19.1 jobs created for every 1MW of commercial-scale solar.

38 Albemarle County. 2020. Workforce & Demographics. Economic Development Department. Accessed on 09 Dec 2022 by https://www.enablealbemarle.org/business-resources/workforce-demographics

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On-Site Questions

ON 2.1 Will the solar project contribute to substantial climate change mitigation?

The scorecard assesses the mitigation performance of a project based on how much of the site's baseline energy consumption (e.g. last 12 months prior to the installation of the project) could be offset by the expected on-site solar generation (refer to the table "On-Site GHG Mitigation Scoring Guide"). For instance, in a project where solar panels are added to a school and only 25% of the school's power is offset by them, it would receive a score of two.

On-Site GHG Mitigation Scoring Guide

Percent Offset	Score
≤ 20	0
21—40	1
41—60	2
61—80	3
81—100	4
> 100	5

External Factor Score

As a general rule, the questions relating to external factors of a project are best answered by talking to local officials, such as municipal climate staff, or activist groups in your community. In cases where questions have more nuance or steps, we outline recommended steps below:

EF 1.3 Will the avoided GHG emissions directly contribute to local climate change mitigation goals?

There are two components to consider in the carbon accounting question: where will the energy from this project go, and who will receive the credit (in the form of Renewable Energy Credits, or RECs)?

It is a common risk in carbon accounting to double count emissions reductions from the source of the reduction and the entity purchasing the credits,[27] and we wanted to be cautious in this analysis to avoid possible fault. Ultimately, deciding who purchases the RECs for the project can be outside of the control of the developer, so we removed this question from the scope of questions that count toward the developer's score, but we kept it as part of the overall project score.

EF 2.1 Will the use of solar on the landscape decrease local tax revenue (0), cause no change (1), or increase tax revenue (2)?

Different localities across the state will have varying tax structures and rates for both on- and off-site solar. Two common structures are (1) charging taxes based on property and equipment value, and (2) charging based on how many MWh are produced at a site. We recommend asking municipal staff members about the expected tax revenue from a project and comparing that to the existing tax revenue generated from a site.

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