FINAL REPORT

Creating Carbon Offsets via a Portfolio of Renewable Energy Purchases and Investments

Climate Solutions Living Lab

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Executive Summary

Unregulated entities can tailor portfolios of renewable energy purchases and investments to align with their carbon offset and co-benefits goals

Introduction

A growing number of environmentally conscious universities, corporations, and other institutions are choosing to voluntarily reduce their greenhouse gas (GHG) emissions, even when they have no legal requirement to do so. These "unregulated entities" have many options to reduce their emissions. They can reduce energy consumption, invest in building efficiency, purchase carbon offsets, or procure renewable energy credits (REC) through purchases and investments in the renewable energy market. The last option—creating carbon offsets via a portfolio of renewable energy purchases and investments—is the focus of this report.

Project Goal

Initially, the goal of this project was to develop a feasible plan to obtain emission reduction offsets, equivalent to at least 50,000 metric tons of CO_2 annually, that an unregulated entity could legitimately and credibly use to offset its emissions (the Target Emissions Reduction). However, if unregulated entities have any feature in common it is variability. Unregulated entities are subject to distinct state and local regulations, and have made disparate progress in greening their energy consumption. In recognition of this variability, we refined the project goal. Instead of designing a single set of options, all of which must be implemented to achieve the Target Emissions Reduction, we developed a portfolio of options that unregulated entities can tailor to their unique values and environmental missions.

Screening Process

Given the inclusivity inherent in a portfolio approach, our screening process focused less on excluding options and more on developing categories from which the unregulated entity can craft its renewable energy purchase and investment strategy. We identified two categories: Operational Excellence and Thought Leadership.

The Operational Excellence category prioritizes *purchases* of RECs through market-tested mechanisms that offer greater certainty of achieving the Target Emissions Reduction, but fewer co-benefits. The Thought Leadership category prioritizes *investments* in renewable energy projects through a novel finance structure that offers more co-benefits, but fewer carbon offsets.

Claiming RECs as Carbon Offsets

RECs represent proof that a given amount of electricity was generated from eligible renewable energy resources and may be sold unbundled from the electricity itself. The decision to purchase RECs to claim carbon emission offsets should be carefully considered due to the difficulty in demonstrating both additionality and the value of the offset achieved. Spot-market purchases of RECs often do not pass credible additionality tests. A low REC price in the spot market most likely represents renewable energy investment that would have occurred under a business-as-usual (BAU) scenario without the added revenue of REC sales. We recommend a strict financial additionality test that requires expected REC purchases to enter into long-term contracts.

REC Selection: Optimizing Health and Other Co-Benefits

Implementing renewable energy projects allows for reductions in air pollution that is reduced by the burning of fossil fuels associated with coal and natural gas. The recommended options will provide public health co-benefits from the reduced combustion of fossil fuels. These co-benefits can be maximized by critically evaluating the geographic location of the project, the sizes of potential projects, and working closely with the project developer. The proposed projects will also produce other co-benefits, such as improved occupational conditions, reduced water and soil contamination, improved environmental justice, and enhanced educational opportunities when renewable energy projects are implemented.

REC Procurement: Renewable Energy Purchase and Investment Portfolio

Option 1: Unbundled REC Purchases

We recommend purchasing unbundled RECs only by means of long-term contracts before project construction, due to the need to firmly establish additionality to credibly use a REC as a carbon offset instrument. We recommend this option to unregulated entities that have low risk tolerance, limited budget for upfront costs, and would like to purchase RECs from locations outside their home state to maximize co-benefits or minimize costs.

Option 2: Bundled REC Purchases

We recommend signing PPAs to purchase RECs bundled with power that allow new renewable projects to be realized. Signing a physical PPA, with power supplied to the buyer's local market, or a virtual PPA, allowing for the maximization of co-benefits, both offer compelling opportunities. Entities signing PPAs may credibly claim additionality if projects would not have been realized without the agreement.

Option 3: REC Equity Investment

High upfront capital costs remain a key limiting factor to the growth of renewable energy. Countless projects that fail to meet thresholds for investor returns remain unbuilt. This innovative investment option is designed to bring these projects online by pairing a low-cost equity investment with a REC Transfer Agreement to increase installations of non-BAU projects, decrease the unregulated entity's carbon footprint, and generate a return on investment.

Conclusion

Creating a portfolio of renewable energy purchases and investments to achieve emissions reduction goals of 50,000 metric tons of CO_2 for an unregulated entity requires consideration of additionality, project location and technology, and procurement options. We recommend creating a portfolio that starts with REC Equity investments and then reinvests the returns from those projects in additional renewable energy purchases and investments. By starting with investments, the unregulated entity can create a portfolio that adds more green energy to the grid and reduces the unregulated entity's carbon emissions through a self-sustaining portfolio of purchases and investments that not only helps the unregulated entity achieve its goals, but also lowers the cost of renewable energy and drives innovation across the industry.

Claiming RECs as Carbon Offsets

Establishing additionality and calculating the time- and location-specific properties of RECs is crucial to credibly claiming carbon offsets

Overview

Renewable energy certificates (RECs) represent proof that a given amount of electricity was generated from eligible renewable energy resources and may be sold unbundled from the electricity itself. The decision to purchase RECs to claim carbon emission offsets should be considered with caution due to the difficulty in demonstrating both additionality and the value of the offset achieved. Spot-market purchases of RECs often do not pass credible additionality tests. A low REC price in the spot market most likely represents renewable energy investment that would have occurred under a business-as-usual (BAU) scenario without the added revenue of REC sales. We recommend a strict financial additionality test that requires expected REC purchases to enter into the investment decision significantly, so long-term purchase agreements are recommended. The unregulated entity should determine that the desired environmental attributes are conveyed by a REC in a given jurisdiction. Environmental benefits, including carbon emissions offsets, are time- and location-dependent. Determining the offsets associated with renewable energy generation requires a modeling trade-off between computational intensity and realism.

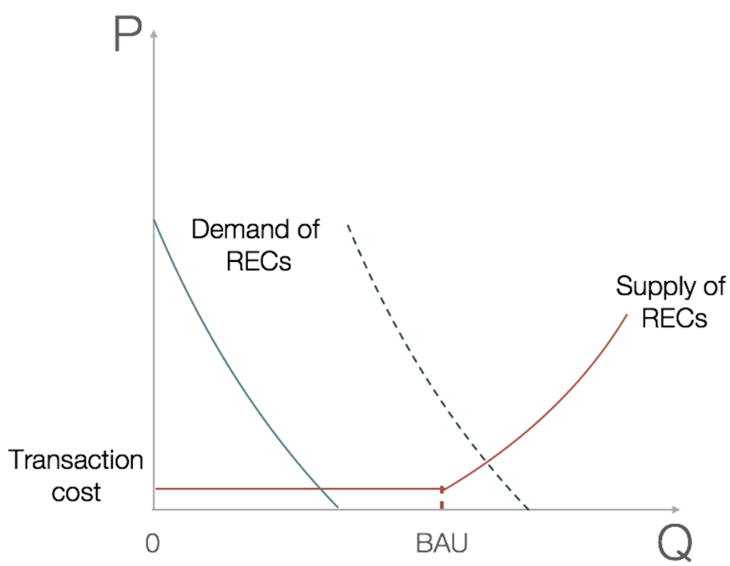
Achieving Additionality

RECs can be purchased in two markets: compliance markets and voluntary markets. In **compliance markets**, RECs are a quota instrument used to meet a state's renewable portfolio standard (RPS). In **voluntary markets**, such as "green power" markets and voluntary GHG offset markets, RECs are implicitly assumed to function as an offset credit instrument. However, RECs not designed as offset instruments, and should pass strict regulatory and financial additionality tests if an unregulated entity wishes to credibly claim carbon offsets via the purchase and retirement of RECs. To pass the **regulatory test**, the REC should not be used to meet RPS requirements and the environmental attributes desired must be bundled with the REC and not used in any other compliance market. To pass the **financial test**, the purchase of the RECs must have affected the decision whether to invest in additional renewable energy generating capacity.

For an unregulated entity to be able to credibly claim to offset emissions via the purchase of renewable energy, it must be demonstrated that the purchase led to a change in behavior from the BAU scenario; otherwise, the total global emissions remain the same, and there has simply been an accounting maneuver to transfer the responsibility for the emissions from one party to another. A credit, be it carbon offset or renewable energy, may be considered additional if the value represented by the credit "would not have occurred in the absence of the activity that generates the credit" (World Bank Group, 2016). A REC may be considered additional only if the creation of the market and its purchase led to the financing of projects that otherwise would not have been economically feasible.

Because some amount of renewable generation capacity investment will occur under the BAU scenario and be allotted RECs, the voluntary purchase of a REC can only achieve additionality if the demand for RECs is greater than the BAU supply of RECs in the market. Even then, much of the RECs available in the market will be part of the BAU supply and not additional. A number of studies have shown no effect of REC purchases in voluntary markets on renewable energy production or investment, primarily because the BAU supply of RECs is greater than the demand (Gillenwater 2008, Gillenwater 2013, Gillenwater et. al 2014). Voluntary market purchases are unlikely to be beyond BAU RECs at current average prices of $0.5-$2/MWh.

Figure 1. Demand for RECs Above and Below the BAU Supply



If demand for RECs does not exceed the BAU supply of RECs, the price will reflect transaction costs and RECs are not additional.

Voluntarily retiring RECs from a compliance market with a stringent quota can lead to additional procurement of renewable energy by regulated entities only if there is a scarcity of RECs in the market. In compliance markets, REC prices vary widely based not only on the project-specific financials but also the stringency of the cap under the RPS. If the cap is set such that it creates market scarcity for RECs, the price of RECs will rise. One indication that marginal voluntary REC purchases from a compliance market are additional is when REC prices approach the penalty fee for non-compliance with the RPS quota (Agnolucci 2007). For instance, RECs purchased on the Texas spot market do not achieve additionality. Texas has a low RPS target relative to its economic supply of renewable energy with current subsidies, yielding very low REC prices average less than $1/MWh in recent years.

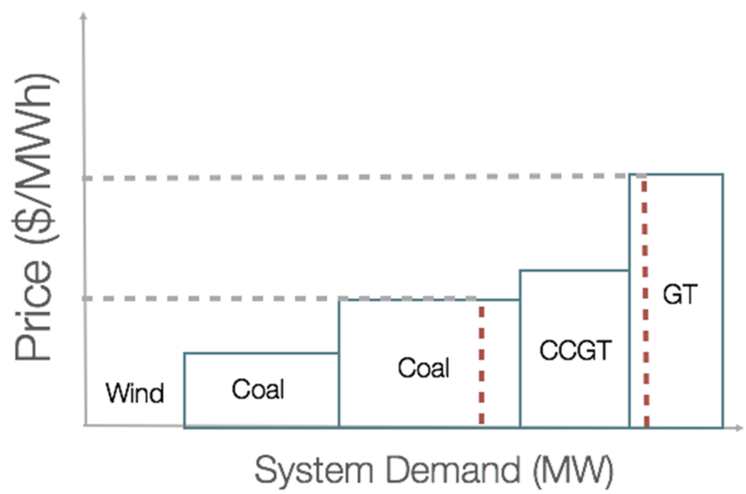
However, even RECs purchased in compliance markets with high prices do not pass strict financial additionality testing. Compliance market spot prices are volatile, subject to regulatory risk, and deeply discounted by developers in the investment decision process. Only with a long-term contract can a voluntary REC purchase provide sufficient income certainty to a project developer to affect the investment decision (Baratoff 2007). Bundled or unbundled RECs purchased via a long-term contract at the time of the project investment decision are likely to represent additional renewable energy generation if the REC purchases enables the internal rate of return to exceed the target rate of return. If the project would not otherwise be built without the expectation of revenue from REC sales, the RECs associated with the project can be considered additional.

Quantification of Offset Value

Credible emission offset accounting requires passing additionality tests, but the fungibility of RECs and carbon offsets requires yet more due diligence of time- and location-specific factors. The effect of an additional MWh of renewable energy depends on the prevailing electricity mix in a given area, which may change over the lifetime of the project. The underlying resource mix may change over time; if the grid decarbonizes as more renewables penetrate the market or thermal units are retired, more renewable energy will be required to offset the same amount of carbon in future years.

The displaced unit at the margin will also vary by time-of-day, yielding different results in different regions and for different technologies. The displaced electricity generating unit (e.g., coal, natural gas plant) may change depending on overall system demand at the time in which the renewable resource is generating. Some locations like California require more GWh of renewable energy to offset the same amount of carbon because the resource mix is less carbon intensive; in contrast, PJM requires less GWh of renewable generation because of the comparatively larger amount of coal, a more carbon-intensive resource, in the generation mix. Variation also exists by technology, as solar and wind have different generation profiles, often displacing different marginal units because of time-variation in output.

Figure 2. Marginal Unit Displacement by Renewable Energy



The overall demand on a system at a given time in a given geography determines the marginal unit displaced. Units may be displaced out-of-merit-order due to security constraints, leading to additional modeling complications.

Modelling Challenges and Assumptions

The modeling choice to quantify avoided emissions from additional renewable generation must balance intensity of computation with realism. Power systems optimization models with subhourly data computationally intensive and require access to data often not publicly available. Statistical and other approaches are insufficient for large structural changes in the resource mix, but helpful for a first pass for marginal changes.

In this analysis, we use AVERT, a statistical tool, to estimate the renewable generation needed by technology type and geographic location to offset 50,000 metric tons of CO_2. Limitations to this method include the use of the 2015 resource mix only, so future year requirements will be underestimated if the carbon intensity of the prevailing resource mix changes. We recommend a more in depth calculation for future studies or at least benchmarking to more realistic power system simulation models.

Table 1. AVERT Results for Wind and Solar Generation Required to Offset 50,000 tons of CO_2 in 2015 in Several Regions in the United States.

Region	Wind Generation	Solar Generation
California	99 GWh	97 GWh
PJM	64 GWh	62 GWh
Texas	83 GWh	82 GWh
New England	94 GWh	94 GWh

Recommendations

A **long-term contract** before project construction is recommended to pass financial additionality testing with confidence. Spot market purchases of RECs, including via REC arbitrage, do not pass strict financial additionality tests required to credibly claim carbon offsets from the renewable energy production. The cost of avoided carbon can be optimized by considering the cost of RECs and the carbon offset value of a REC in a given region. This methodology is further explored in subsequent sections.

REC Selection: Optimizing Health and Other Co-Benefits

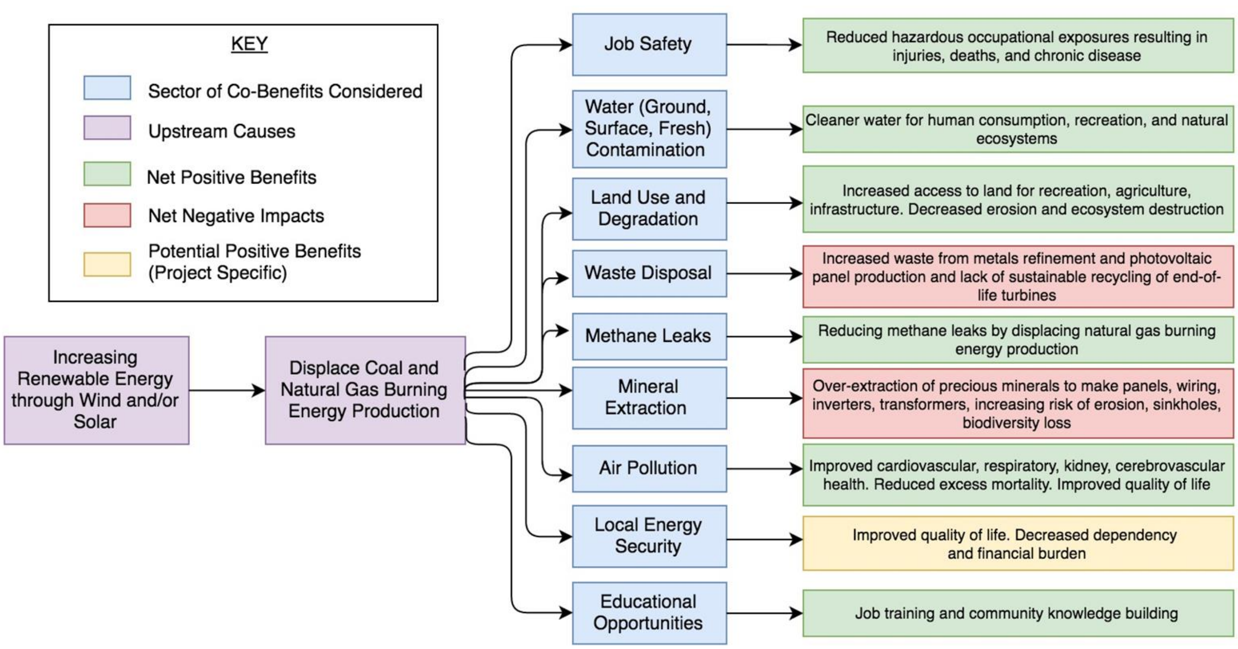
Evaluating the benefits accrued through renewable energy projects with respect to different geographic locations, project size, and technology type is essential

Overview

To assess potential health and other co-benefits from a portfolio of renewable energy projects, both quantitative and qualitative information is used. The Estimating Air Pollution Societal Impacts Using Regression (EASIUR) model can be utilized to calculate the social costs of pollution reductions associated with the immediate reductions in the burning of fossil fuels through the implementation of a renewable energy portfolio (Heo et al. 2016). EASIUR estimates marginal social costs and intake fractions of emissions from large datasets of tagged locations with chemical transport models with very high spatial resolution (36 km x 36 km). Based on an input latitude and longitude, we are able to estimate the social marginal damage (in dollars) per ton of emission for primary PM2.5, SO_2, and NOx, over four seasons, and at three emissions heights—ground, 150 meters and 300 meters.

When analyzing other co-benefits that occur more indirectly through job growth, occupational hazard reduction, educational opportunities, etc., a full Health Impact Assessment is needed. Here, we outline, qualitatively, the potential for maximizing benefits and minimizing harms through specific program design opportunities when implementing solar or wind projects, as compared to coal and natural gas.

Figure 3. Potential Health and Other Co-Benefits from Renewable Energy Projects



Steps for Implementation

Assess Health Benefits via the Marginal Damages of Emissions

1. Determine latitude and longitude of the site where emissions are avoided from displacing coal or natural gas power plants based on EPA's AVERT or another modeling tool.
2. Utilize the Estimating Air Pollution Societal Impacts Using Regression (EASIUR) model (Heo et al. 2016a, Heo et al., 2016b) to estimate marginal social costs at that latitude and longitude, which is available at: http://barney.ce.cmu.edu/~jinhyok/easiur/online/.
3. Select the dollar year (1980-2010), income year (1990-2024), and population year (2000-2050) that is most appropriate for your chosen analysis.
4. Review the output of your analyses for the pollutants included – primary PM2.5, SO_2, NOx, and NH3 – the four seasons assessed, and the three emissions heights covered (ground, 150 meters and 300 meters).

Note: to fully quantify the full range of health and other co-benefits, a detailed Health Impact Assessment and Environmental Impact Assessment should be conducted to ensure that the selected project(s) are optimizing co-benefits and minimizing harms done to the surrounding communities, ecosystems, and atmosphere. Through this assessment, the unregulated entity could determine quantitatively the specific improvements in morbidity and mortality based on the geographic region of choice. Here, because of time and resources available, a catalog of potential externalities, their mechanistic pathway, and ways to maximize benefits and minimize harms are outlined and identified as key areas to assess when implementing a project.

An Ideal Health Impact Assessment (HIA) would contain the following:

1. Screening of the feasibility and value of the HIA.
2. Scoping of potential health effects and other externalities related to the decision, while identifying evidence and stakeholder roles.
3. Assessment of the potential health effects using evidence of baseline conditions, expected conditions post-decision making, and uncertainty regarding this evidence.
4. Recommend strategies to mitigate harms and maximize benefits via design strategies or alternative decisions.
5. Reporting and communicating the process, findings, and recommendations to the necessary stakeholders.
6. Monitor health and co-benefits during and after implementation to measure outcomes that were impacted by the decision.

Recommendations

Based on the analyses throughout this report, as well as previous literature, there are some locations where the co-benefits accrued are favorable for implementation over other projects. As described by Siler-Evans et al. (2013), wind energy in the Appalachian Mountains provides the greatest social benefits. Because of the high amount of carbon dioxide emissions avoided in a grid with a lot of pre-existing coal and the resulting NOx, SO_2, and $PM_{2.5}$ pollutants, wind in West Virginia would have the greatest amount of co-benefits. From our screening and feasibility analyses previously conducted, solar and wind within the Pennsylvania-New Jersey-Maryland Interconnection LLC (PJM) or within ISO New England (ISO-NE) would provide high levels of benefits given the costs. An unregulated entity can prioritize which co-benefits they would like to maximize and choose project locations accordingly. The implementation plan provided here provides information on how to move forward with renewable energy investments in any area, and how to assess which project type and financing structure may be optimal for an unregulated entity's needs. It will be essential during project development to incorporate local community members and continual monitoring to ensure the predicted co-benefits are maximized to their full potential.

In the Appendix, there is a catalog of potential harms and benefits associated with electricity generation from coal and natural gas as compared to solar and wind energy that should be considered in a full Health Impact Assessment or Environmental Impact Assessment. As shown below, the potential benefits provided by solar and wind greatly outweigh the few potential harms that are possible as compared to the harms incurred by the burning of coal and natural gas for electricity generation. This is especially true if care is taken to mitigate potential harms with design solutions and best practices when siting and implementing the project.

REC Procurement:
Renewable Energy Portfolio Purchase and Investment Options

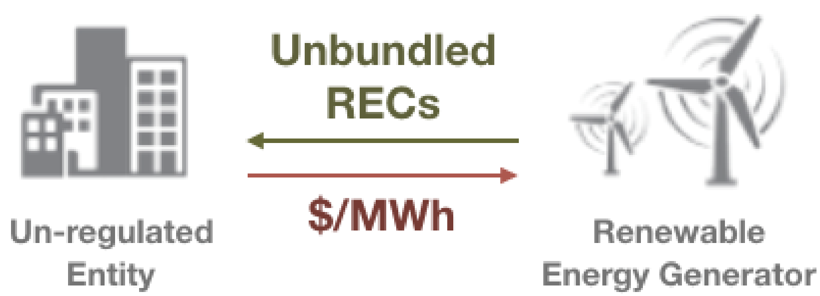
Option 1: Unbundled REC Purchases

Purchasing unbundled RECs via a long-term contract can create additional renewable energy generation and reduce carbon emissions

Overview

Unbundled RECs can be purchased in either the spot market (voluntary or compliance), or via a long-term purchase agreement. Due to the need to firmly establish additionality to credibly use a REC as a carbon offset instrument, we recommend purchasing unbundled RECs through long-term contracts before project construction. However, spot market purchases of RECs can pass a weak financial additionality test in some cases, which are explored in the Feasibility Report but excluded from this Implementation Plan.

Figure 4. Long-Term REC Purchase Agreement



Recommendations

This option allows unregulated entities to pursue long-term emission reduction goals by providing financial support to non-BAU renewable energy projects. A long-term contract helps mitigate the risk of having volatile market prices of RECs for both the unregulated entity and the renewable project.

The implementation of this option is not constrained by the geographic location of the unregulated entity. We recommend REC purchases in either the local state of unregulated entity where it can maximize its local co-benefits, or in locations with high carbon intensity and pollutant emissions.

For unregulated entities that prioritize Operational Excellence, we recommend REC purchases from projects implementing proven technologies, such as on-shore wind and solar PV generation.

For unregulated entities that prioritize Thought Leadership, we recommend REC purchases from projects implementing innovative technologies, such as off-shore wind, utility-scale solar thermal generation, and storage systems.

Steps for Implementation

1. Establish a REC Purchase Committee at the Unregulated Entity
Determine which division at the unregulated entity will oversee the process of long-term REC purchase implementation and guide the unregulated entity through the legal and technical analysis and financial contracting process.

2. Narrow the Selection of Renewable Projects Based on Technology and Location Criteria
Cost, health benefits and other co-benefits depend on the location and the technology of a project.

3. Design a "Project-Based" Additionality Test
For the RECs purchased to be additional, the revenue from the RECs and the long-term certainty of this revenue must be a primary driver for implementation of the renewable project. To avoid making this test subjective, the committee, with the assistance of consultants (if needed), must establish standardized criteria for what amount of revenue qualifies as a "primary driver." Based on the operational features required from the project and projected wholesale prices of electricity, the committee could compare the IRR of the project with and without revenue from REC sales, with the investors' target rate of return to determine whether the secured long-term revenue from REC sales significantly increases the investors' probability to invest (Gillenwater 2013, Bode et al. 2003).

4. Identify a Pre-construction Project that Meets the Additionality Test, Emissions Avoided Target, and Cost Constraints of the Unregulated Entity
The unregulated entity should identify a pre-construction renewable energy project based on the screening from steps 2 and 3, and other factors, such as their demand of RECs, time length of the purchases, and their budget constraint.

5. Negotiate a Long-term REC Purchase Agreement with the Identified Renewable Project Company
The unregulated entity should negotiate a long-term REC purchase agreement with the identified renewable project company, regarding the number of RECs being purchased each year, the unit price of a REC, terms of the contract price and any annual increases, the length of the contract, timing and guarantee of the transactions.

6. Properly Retire the RECs to Claim Carbon Emissions Reduction

To claim the green attributes, the unregulated entity must retire the RECs after it receives them from the renewable project. Thereafter, the unregulated entity can convert the MWh of green energy associated with the RECs into avoided emissions via time- and location-specific modeling tools to estimate the effects of avoided fossil fuel generation. The carbon offset could be roughly estimated by a simple model, such as AVERT, which estimates the emission avoided on an hourly-base. To calculate the carbon offset more accurately, the unregulated entity may consult with a third party to estimate the carbon avoided from a marginal power plant on a shorter time scale with more realistic operating characteristics of the system.

Cost Analysis

The cost of spot-market REC or SREC purchases in three regions (PJM, Texas, and New England) are summarized in Tables 2 and 3. The costs are estimated based on the historical price of RECs ($/MWh) in the compliance market in different states (O'Shaughnessy et al. 2015), and the amount of additional renewable energy required to fulfill our goal of 50,000 metric ton CO_2 emission reduction simulated from AVERT.[1] To calculate long-term purchase NPV, we assume a 7-year REC purchases agreement with a fixed REC price and a 7% discount rate. Long-term purchase agreement REC prices may vary considerably from the spot-market benchmarking shown here.

Table 2. Cost Estimate of Long-term Unbundled REC Purchases

Region	Wind generation (MWh)*	REC price ($/MWh)†	Annual cost ($K)	Cost of carbon avoided ($/ton)	Long-term purchase NPV ($M)
PJM	64000	10-20	640-1280	13 - 26	3.6-7.2
Texas	83000	0-2	<166	<3.3	<1.0
New England	94000	40-60	3600-5400	72 - 108	20-30

[1] AVERT is a model simulating the avoided carbon emissions, and other pollutants from avoided fossil fuel generation with additional renewable capacity added. The results are based on the grid energy mix in 2015. The 2015 mix is held constant for the 7 years of the analysis. In reality, we expect many of these regions to decarbonize as they meet increasingly stringent RPS targets, which would raise the cost of avoided carbon.

Table 3. Cost Estimate of Long-term Unbundled SREC Purchases

Region	Solar generation (MWh)*	REC price ($/MWh)†	Annual cost ($K)	Cost of carbon avoided ($/ton)	Long-term purchase NPV ($M)
PJM	62000	50-200	3100-12400	62 - 248	20-70
Texas	82000	NA	NA	NA	NA
New England	94000	200	18800	376	90

* Calculated from AVERT using 2015 Regional Data Files
† Source: O'Shaughnessy et al. (2015)

Option 2: Bundled REC Purchases

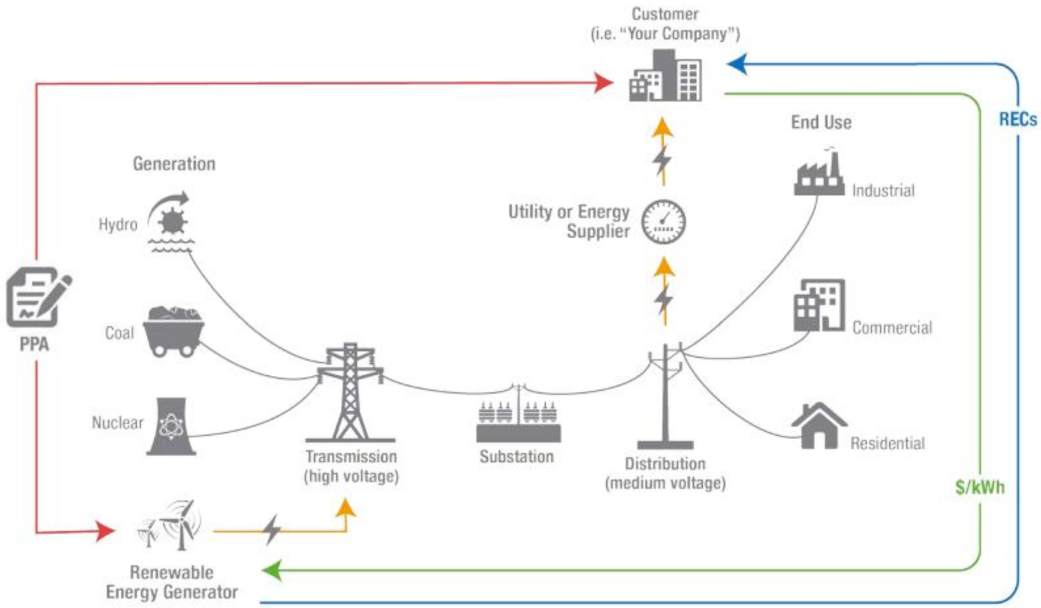
Purchasing power and the associated RECs directly from generators through long term contracts promotes additional renewable energy generation and reductions in carbon emissions

Overview

A power purchase agreement (PPA) is a contract between a generator of electricity (the seller) and a purchaser of electricity (the buyer). The PPA typically provides financing for a renewable energy project through a fixed price per MWh generated over a fixed term, or with agreed-upon adjustment mechanisms. The project developer carries out installation, interconnection, operation, maintenance, and repair of the renewable energy system for the duration of the contract, usually 15 to 25 years. The long-term contract for a fixed price is a key dynamic that allows the developer to secure financing for a renewables project.

PPA contracts can be either "physical," in which the power purchased is supplied to the market directly servicing the unregulated entity, or "virtual," in which the power is in a separate market from the unregulated entity. In physical PPAs, the unregulated entity purchases the power and associated RECs generated together, retiring or selling RECs as needed. The buyer of the physical PPA is hedged against the wholesale market rate for power for the amount of contracted generation because the buyer's energy costs are kept flat. Electricity prices are expected to increase over time, making a fixed price highly advantageous. However, this is not guaranteed, and the buyer should have a sophisticated understanding of the market dynamics. The buyer must have power marketing authority from the Federal Energy Regulatory Commission (FERC) or contract with a market participant who does, making a physical PPA difficult to implement for some entities in some jurisdictions.

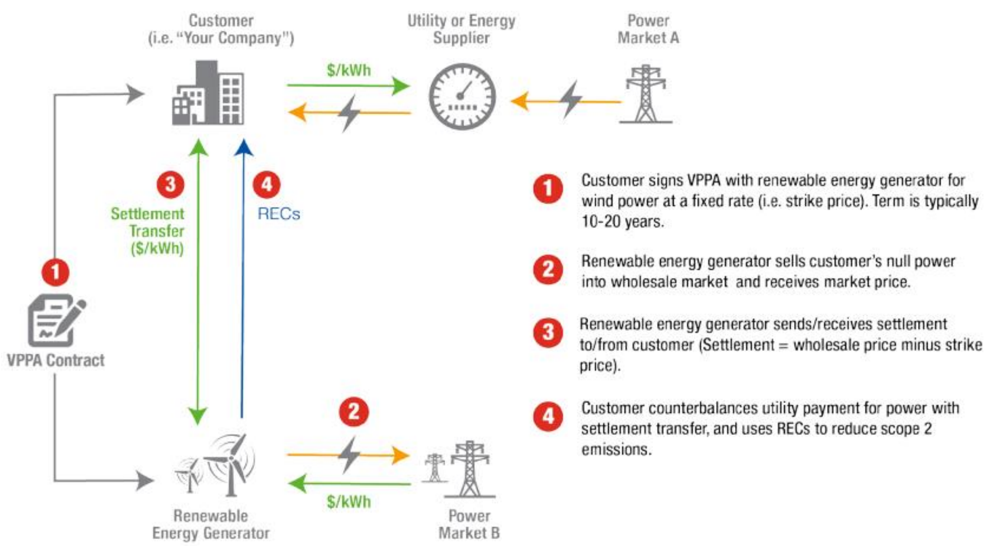
Figure 5. Physical PPA Arrangement



Source: Kent 2016

Note for Figure 6 A virtual PPA is a financial contract-for-differences, not a physical contract. In virtual PPAs, the unregulated entity receives the RECs generated, while the power generated is sold into the local power market and the two parties settle the differences based on the market price.

Figure 6. Virtual PPA Arrangement

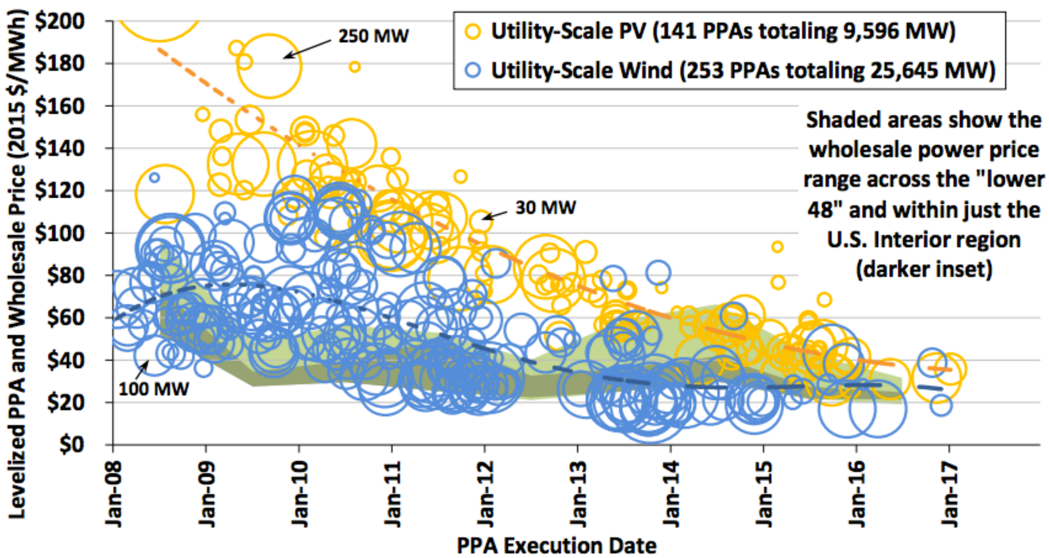


Source: Kent 2016

Assessment of PPA Prices

Levelized PPA prices, including the price of electricity and RECs, have declined compared to electricity wholesale prices, approaching and beating wholesale power prices in some cases (Figure 7). Average utility-scale solar and wind PPA prices in 2016 neared $50/MWh and $20/MWh, respectively, including federal and state subsidies. PPA prices have historically been nudged upwards by political or public barriers to acceptance of projects, interconnection issues, a lack of incentives, and regulatory complexity. If more RECs bundled with power are purchased than are needed to be retired, the excess may be sold.

Figure 7. PPA Contract Prices over Time



Source: O'Shaughnessy et al. (2015). This figure shows the PPA prices, levelized over full contract term at a discount rate of 7%, signed in bilateral utility-scale contracts since January of 2008. Prices include both energy and RECs. The size of the circle represents the nameplate capacity (MW) of the project, yellow being solar and blue being wind. The dotted lines show the average price, both trending down over time. The shaded green region shows the range of wholesale prices over the same time period.

Recommendations

A physical PPA ensures that the unregulated entity is truly working towards supplying its own energy use with renewables and furthering renewable energy penetration in their power market. The physical PPA also provides a full price hedge for the cost of electricity for the entity. However, this option will limit flexibility in minimizing the cost of avoided carbon and maximizing co-benefits, and is not feasible from a regulatory perspective for all entities.

A virtual PPA may be preferred for geographic flexibility. The unregulated entity should support a renewable energy project in a geographic area that optimizes the associated GHG emissions reductions and co-benefits with the price of RECs in that market. The least expensive prices for PPAs are the Southwest, California, and Texas for solar and the Interior and Great Lakes for wind. The greatest SO_2 and NO_X emissions reductions associated with projects that avoided 50,000 tons of CO_2 are in the mid-Atlantic region, displacing coal generation as opposed to cleaner natural gas in other regions.

As in all procurement options, the unregulated entity should practice due diligence with respect to financial additionality. The long-term contract should be necessary to affect the decision to invest in the project. In contrast to other procurement options, bundled RECs in the form of PPAs often require contract durations of the project lifetime, on the order of 15-20 years. This contract length may be undesirable for some unregulated entities that are accustomed to procuring energy on shorter time frames.

Steps for Implementation

1. Create a PPA Procurement Committee
Determine which division will oversee the PPA implementation process and guide the unregulated entity through the legal and technical analysis and financial contracting process.

2. Establish Selection Criteria that Align with Mission
Key terms to consider for the selection criteria include:

- Physical or Virtual PPA
- Price/kWh
- MWh of generation and associated RECs
- Technology / location
- Length of Contract
- Tax code/government subsidy landscape
- Co-benefits: health, water usage, energy price risk, lifecycle analysis, wildlife, local community, economy

3. Design a "Project-Based" Additionality Test
Similar to the additionality test outlined in Option 1, for the RECs purchased to be additional, the revenue from the generated power and the bundled RECs and the long-term certainty of this revenue must be a primary driver for implementation of the renewable project. To avoid making this test subjective, the committee, with the assistance of consultants (if needed), must establish standardized criteria for what amount of revenue or certainty of revenue qualifies as a "primary driver." Based on the operational features required from the project and projected wholesale prices of electricity, including uncertainty, the committee could compare the IRR of the project with and without revenue from long-term contract, with the investors' target rate of return

to determine whether the secured long-term revenue from the agreement significantly increases the investors' probability to invest (Gillenwater 2013, Bode et al. 2003).

4. Competitively Select a PPA Contract

- Issue a request for proposal
- OR Directly approach developers
- Conduct benefit-cost analyses of proposals

5. Identify a Pre-construction Project that Meets the Additionality Test, Emissions Avoided Target, and Unregulated Entity's Cost Constraints

The unregulated entity should identify a pre-construction renewable energy project based on the screening from steps 2, 3, and 4 and other factors, such as their demand of RECs, time length of the purchases, and their budget constraint.

6. Negotiate a Long-term Power Purchase Agreement with Bundled RECs with the Identified Renewable Project Company

The unregulated entity should negotiate a long-term REC purchase agreement with the identified renewable project company, regarding the number of RECs being purchased each year, the unit price of a REC, terms of the contract price and any annual increases, the length of the contract, timing and guarantee of the transactions.

7. Project Design, Procurement, Construction, Commissioning

The system owner and operator would be responsible for project development and claiming of applicable tax credits and incentives. The unregulated entity should obtain verification of relevant filings, oversight of timeline, and guarantee of service.

8. Properly Retire the RECs to Claim Carbon Emission Reduction

To claim the green attributes, the unregulated entity must retire the RECs after it receives them from the renewable project. Thereafter, the unregulated entity can convert the MWh of green energy associated with the RECs into avoided emissions via time- and location-specific modeling tools to estimate the effects of avoided fossil fuel generation. The carbon offset could be roughly estimated by a simple model, such as AVERT, which estimates the emission avoided on an hourly-base. To calculate the carbon offset more accurately, the unregulated entity may consult with a third party to estimate the carbon avoided from a marginal power plant on a shorter time scale with more realistic operating characteristics of the system.

Cost Analysis

The cost of wind and solar PPA in four regions (Northeast, Interior, Southwest, and Texas) are summarized in Tables 4 and 5. The costs are estimated based on recent bilateral, utility scale PPA prices (Bolinger et al. 2015, Wiser et al. 2015) and the amount of additional renewable energy required to fulfill our goal of 50,000 metric ton CO2 emission reduction simulated from AVERT. Since these prices include both electricity and RECs, for reference, the average historical wholesale price of electricity for each region is noted. To calculate long-term purchase NPV, we assume a 15-year PPA with a fixed price and a 7% discount rate.

Table 4. Cost Estimate of Long-term Wind PPA

Region	Wind Generation (MWh)*	PPA price, RECs + Energy ($/MWh)†	Average Historical Wholesale Price ($/MWh)‡	PPA Annual cost ($K)	Cost of carbon avoided ($/ton)	Long-term purchase NPV, RECs + Energy ($M)
Northeast	93000	60	61.02	5580	111.6	50.8
Interior (including Texas)	60000	20	32.94	1200	24	10.9

Table 5. Cost Estimate of Long-term Solar PPA

Region	Solar generation (MWh) *	PPA price, RECs + Energy ($/MWh)†	Average Historical Wholesale Price ($/MWh)‡	PPA Annual cost ($K)	Cost of carbon avoided ($/ton)	Long-term purchase NPV, RECs + Energy ($M)
Southwest	97000	30 - 40	44.87	2910 - 3880	58.2 - 77.6	26.5 - 35.3
Texas	82000	35 - 45	32.94	2870 - 3690	57.4 - 73.8	26.1 – 33.6

* Calculated from AVERT using 2015 Regional Data Files

† Prices reflect PPAs signed in 2015. Source: Bolinger et al. (2015) and Wiser et al. (2015)

‡ Source: Energy Information Agency Wholesale Electricity Market Data. Average prices from 2001-2016 for Northeast (Massachusetts Hub) and Southwest (Palo Verde Hub) and from 2014-2016 for Texas (ERCOT-North Hub).

Option 3: REC Equity Investment

Equity investment can enable the unregulated entity to increase renewable energy installations, decrease its emissions, and earn a return on investment.

Overview

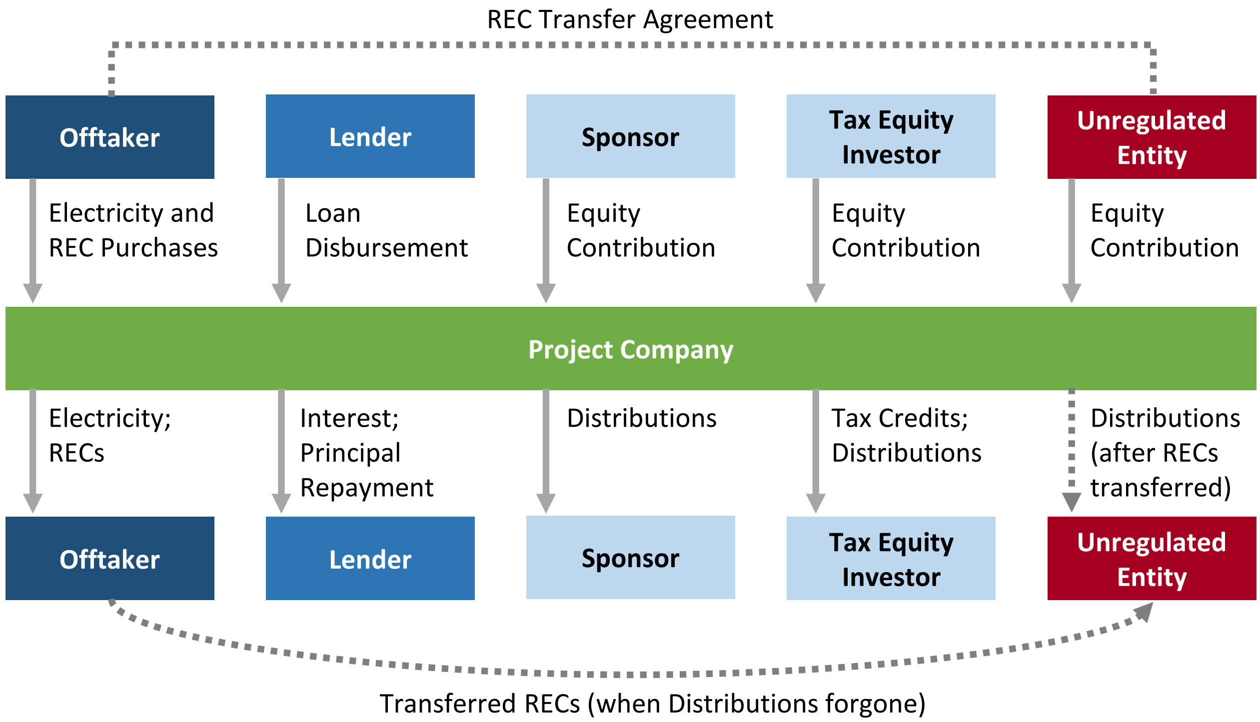
High upfront capital costs remain a key limiting factor to the growth of renewable energy. Countless projects that fail to meet thresholds for investor returns remain unbuilt. This innovative investment option is designed to bring these projects online by pairing a low-cost equity investment with a REC Transfer Agreement to increase installations of non-BAU projects, decrease the unregulated entity's carbon footprint, and generate a return on investment.

Modeled after tax equity investing structures, which have been used with great success in the renewable energy industry, REC Equity brings the unregulated entity into the project as a REC Equity investor. Under this structure, the equity component is implemented through the unregulated entity purchasing a minority interest in the project. To reduce the project's capital costs, the unregulated entity agrees to forgo distributions for a limited initial period. In turn, this deferral permits the other investors to achieve their target returns and thus enables the installation of a project that would not receive financing but for the REC Equity investment.

The analogy to tax equity comes to fruition through the REC component of this structure. Like tax equity investors accepting lower returns on their investment for the project's tax attributes, the unregulated entity reduces its return threshold in exchange for a share of the project's RECs. To link the low-cost equity investment to RECs, the unregulated entity and offtaker execute a REC Transfer Agreement to transfer a share of the RECs to the unregulated entity whenever it forgoes cash distributions. Notably, this transfer provides a mechanism by which the unregulated entity can claim it has reduced its emissions.

The REC Equity financing structure is illustrated conceptually in Figure 8 and quantitatively in Figure 9. Both figures are intended to provide context for the implementation steps. Thereafter, to underscore the value of this novel investment structure, the recommendations describe an example investment in a utility solar project in the PJM region. The purpose of this example is to show that REC Equity can enable the unregulated entity to increase installations of non-BAU projects, decrease the unregulated entity's carbon footprint, and generate a return on investment.

Figure 8: REC Equity Finance Structure



Required Legal Documents				
Offtaker	**Lender**	**Sponsor**	**Tax Equity Investor**	**Unregulated Entity**
Executes a Power Purchase Agreement with the Project Company to purchase electricity and RECs (if bundled) Executes a REC Transfer Agreement with the Unregulated Entity to transfer RECs (during the deferral period)	Executes a Loan Agreement with the Project Company to provide debt financing based on the expected cash flows from the sale of electricity and RECs	Executes a Partnership Agreement with the other Equity Investors to contribute equity to the Project Company in exchange for a share of the distributable cash	Executes a Partnership Agreement with the other Equity Investors to contribute equity to the Project Company in exchange for tax credits, depreciation under the Modified Accelerated Cost Recovery System (MACRS), and a share of the distributable cash	Executes a REC Transfer Agreement with the Offtaker to receive RECs during the deferral period Executes a Partnership Agreement with the other Equity Investors to contribute equity to the Project Company in exchange for a deferred share of the distributable cash

Legal Note for Figure 8

This structure assumes that the Unregulated Entity has the capability and authority to make equity investments in renewable energy projects. Acquiring the capability may require adding experienced personnel, while obtaining authority may require Board of Directors or equivalent approval.

Financial Note for Figure 9	The analysis that appears in Figure 9 below is illustrative. It assumes that the project company only sells RECs and that all of the cash from the REC sales is distributable. Outputs from a more robust project model appear in the figures accompanying the example investment.

Figure 9. How REC Equity Works: An "Illustrative" Analysis [(a)]

	Equity Investment	Project Year 1	2	3	4	5	IRR (b)	Comment
Sponsor Ask:								
REC Price ($/MWh)		$50	$50	$50	$50	$50		• Sponsor asks for a price
MWh		100	100	100	100	100		of $50/MWh for RECs to
REC Sales		$5,000	$5,000	$5,000	$5,000	$5,000		achieve a 20% IRR
Distributions to Sponsor	($15,000)	$5,000	$5,000	$5,000	$5,000	$5,000	20%	
Offtaker Bid:								
REC Price ($/MWh)		$48	$48	$48	$48	$48		• Offtaker's maximum
MWh		100	100	100	100	100		willingness to pay of
REC Sales		$4,800	$4,800	$4,800	$4,800	$4,800		$48/MWh for RECs
								drops the IRR below
Distributions to Sponsor	($15,000)	$4,800	$4,800	$4,800	$4,800	$4,800	18%	the Sponsor's threshold
Bid-Ask Gap:								
REC Price ($/MWh)		($2)	($2)	($2)	($2)	($2)		• REC Equity is designed to
Distributions to Sponsor		($200)	($200)	($200)	($200)	($200)	(0%)	bridge this bid-ask gap
Negotiated Price:								
REC Price ($/MWh)		$45	$45	$45	$45	$45		• Unregulated Entity makes
MWh		100	100	100	100	100		an equity investment, but
REC Sales		$4,500	$4,500	$4,500	$4,500	$4,500		forgoes cash distributions
								in year 1 to eanble the
Distributions to Sponsor	($10,500)	$4,500	$3,150	$3,150	$3,150	$3,150	20%	Sponsor to achieve a
Distributions to Unregulated Entity (c)	($4,500)	$0	$1,350	$1,350	$1,350	$1,350	5%	20% return
Offtaker Savings:								
Offtaker Bid ($/MWh)		$48	$48	$48	$48	$48		• The Unregulated Entity's
Negotiated Price ($/MWh)		$45	$45	$45	$45	$45		investment in the project
Offtaker Savings ($/MWh)		$3	$3	$3	$3	$3		enables the Offtaker to
								to save $3/MWh
MWh		100	100	100	100	100		(equivalent to $300/year
Offtaker Savings		$300	$300	$300	$300	$300		based on MWh output)
REC Transfer:								
Forgone Cash Distribution (d)		Yes	No	No	No	No		• When the Unregulated
								Entity forgoes cash
Offtaker Savings		$300						distributions, the Offtaker
Negotiated Price ($/MWh)		$45						is obligated to transfer
RECs Transferred (MWh)		7						a share of RECs equal in
								value to its savings
RECs with Offtaker (MWh)		93	100	100	100	100		($300/$45MWh)

(a) This financial analysis makes a number of simplifying assumptions to illustrate the mechanics of REC Equity. It is not intended to represent a robust project model.
(b) The IRR are based on the illustrated 5-years of cash flows.
(c) The Unregulated Entity IRR is illustrative. It does not reflect a target return.
(d) The initial deferral period may be longer than 1 year. Here, the deferral period is one year because the returns are based on only 5 years of cash flows. A longer project life, such as 20 years, can support longer deferral periods.

Steps for Implementation

1. Establish an Investment Team at the Unregulated Entity

Effective equity investing requires distinct expertise from that associated with REC purchases and negotiating PPAs. Before moving forward with this option, the unregulated entity should establish an investment team, either by hiring professionals with energy investing expertise or partnering with existing teams within the unregulated entity who already have this expertise. For example, a private university's Office for Sustainability could partner with or, perhaps, hire professionals from the team that manages the university's endowment fund.

2. Design a Standardized Investment Test for Additionality

This option centers implementation on the "investment test" for additionality. Revenue from the RECs is a primary driver for implementation. To avoid making this test subjective, the Investment Team, with the assistance of consultants (if needed), should establish standardized criteria for what amount of revenue qualifies as a "primary driver" and what gap between the asking price for RECs and the offtaker's willingness to pay is truly a barrier to financing the project. Put differently, an impasse between one offtaker and one set of investors may be insufficient to satisfy the investment test. Instead, the case for additionality could be strengthened by placing the gap in the context of broader market prices.

3. Select a Standardized Method for Estimating Emissions Avoided

Acquiring a REC by itself does not permit the unregulated entity to claim an emissions reduction. Further analysis is required to estimate the emissions avoided by the project's contribution of green energy to the grid. One way to perform this analysis is to use the EPA Avoided Emissions and generation Tool (AVERT), which estimates the emissions benefits of installing new wind and solar projects. As part of this step, this tool (or another one like it) should be used to establish an emissions avoided floor below which the unregulated entity will not provide low-cost equity financing even if revenue from RECs is a primary driver of project implementation.

4. Identify a Project that Meets the Additionality Test and Exceeds the Emissions Avoided Floor

Leveraging the work from steps 2 and 3, the unregulated entity should screen for renewable energy projects where the asking price for RECs is greater than the offtaker's willingness to pay in accordance with the standardized additionality test. Other factors, such as technology, size, and location may become barriers based on the emissions avoided test—either because the project falls below the emissions avoided floor or because a tool like AVERT estimates emissions benefits only for certain technologies (wind, utility-scale solar, and rooftop solar).

5. Negotiate Partnership Agreement with Equity Investors

Garnering buy-in from the investors whose asking price is above the offtaker's willingness to pay is vital for this structure to work. Although these investors would likely appreciate a pathway to higher returns, they may resist reducing their investment amount to preserve their ownership position in the project. However, the unregulated entity can address this objection by emphasizing that the project would not be possible without a change in the ownership allocations and, if needed, by adjusting various governance rights in the Partnership Agreement to enable the sponsor to achieve control equivalent to what it would have had if its ownership had not been reduced. Regardless of the ultimate bargain, the unregulated entity's equity contribution should be contingent on the offtaker signing a PPA and REC Transfer Agreement to ensure that an ability to claim emission reductions accompanies the equity investment.

6. Negotiate REC Transfer Agreement with Offtaker

This step is critical to unlocking the value of REC Equity. Normally, an offtaker who buys bundled RECs either retires the RECs to claim their green attributes or sells them to a third party. Under the REC Equity structure, the offtaker transfers a portion of its RECs to the unregulated entity at a nominal cost whenever the unregulated entity forgoes cash distributions during a defined initial period. Although the offtaker may be unaccustomed to this novel structure, the unregulated entity can show its value to the offtaker by demonstrating that REC Equity lowers the REC price below what the offtaker would normally pay. This way the transfer can be framed as a transaction that rewards the unregulated entity with RECs in exchange for reducing the offtaker's outlay for RECs over the term of the PPA.

7. Retire Transferred RECs and Estimate Emissions Avoided

To claim the green attributes, the unregulated entity must retire the RECs after it receives them from the offtaker. Thereafter, the unregulated entity can convert the MWh of green energy associated with the RECs into an emissions avoided estimate to track its progress against the target emissions reduction.

8. Invest Distributions into Other Renewable Energy Projects

After the deferral period, the unregulated entity will begin to receive cash distributions from the project. These distributions provide a source of capital that the unregulated entity can use to fund additional renewable energy purchases and investments to reduce its carbon emissions.

Recommendations

REC Equity is specifically designed to enable the installation of projects that would otherwise not be built under BAU circumstances. Within this group of projects, we recommend selecting projects for which (1) the social benefits based on emissions avoidance are greater than the upfront investment cost; and (2) the REC price range is sufficiently broad that the offtaker and equity investors are unlikely to agree on a REC price that satisfies both parties in the absence of a REC Equity investment. Figure 10 illustrates an example selection of a PJM utility solar project based on these criteria. Figure 11 replicates Figure 9 with inputs based on the selected PJM utility solar project.

Figure 10. Project Selection Based on Net Social Benefits [a]

	Utility Solar		Wind		
	PJM	New England	PJM	New England	Selection Process
AVERT Estimates:					
Nameplate Capacity (MW)	40	60	28	53	• Use AVERT to estimate the required MWh in renewable energy to avoid 50,000 metric tonnes of CO2
Capacity Factor	18%	18%	26%	20%	
Annual Generation (MWh)	62,000	94,000	64,000	93,000	
Project Cost:					
Installation Cost ($/W) (b)	$2.00	$2.00	$2.30	$2.30	• Determine the required investment amount based on the estimated installation costs for projects sized to the AVERT estimates
Installation Cost ($)	$80,000,000	$120,000,000	$64,400,000	$121,900,000	
Investment for 5% Ownership	**$4,000,000**	**$6,000,000**	**$3,220,000**	**$6,095,000**	
Social Benefits:					
CO2 Avoided (tonnes) (c)	50,000	51,200	50,400	50,500	• Calculate the social benefits derived from the emissions reductions that result from installing the analyzed renewable energy projects
Social Benefit ($/tonne) (d)	$40	$40	$40	$40	
Social Benefit from CO2 Avoidance	$2,000,000	$2,048,000	$2,016,000	$2,020,000	
SO2 Avoided (tonnes) (c)	96	28	104	28	
Social Benefit ($/tonne) (e)	$33,500	$25,000	$33,500	$25,000	
Social Benefit from SO2 Avoidance	$3,225,975	$692,863	$3,482,777	$712,141	
NOx Avoided (tonnes) (c)	39	28	41	26	
Social Benefit ($/tonne) (f)	$17,750	$8,490	$17,750	$8,490	
Social Benefit from NOx Avoidance	$690,799	$239,518	$732,666	$217,954	
Total Social Benefit (TSB)	**$5,916,775**	**$2,980,381**	**$6,231,443**	**$2,950,095**	• Select the project for which (1) the TSB is greater than the investment and (2) the REC/SREC price range is broad enough to permit REC Equity to bridge the bid-ask gap
Net Benefit (TSB less Investment)	**$1,916,775**	**($3,019,619)**	**$3,011,443**	**($3,144,905)**	
REC Price Range ($/MWh)	--	--	**$10 - $20**	**$40 - $60**	
SREC Price Range ($/MWh)	**$50 - $200**	**$200**	--	--	

(a) The social benefits are based on CO2, SO2, and NOx avoided because AVERT provides avoidance estimates only for these emissions. An unregulated entity could include other benefits as long as the value attributed to them is defensible. CO2, SO2, and NOx benefits are added for illustrative purposes. In practice, the values would require further refinement to account for the emissions being avoiding collectively, rather than individually.

(b) The installation costs are based on the National Renewable Energy Laboratory (NREL) estimates of costs for wind and solar projects with nameplate capacities greater than 10MW. These estimates were last udpated in Feburary 2016. The $/MW figures have been rounded.

(c) The CO2, SO2, and NOx avoided were estimated using the AVERT tool.

(d) The $40/tonne social benefit of CO2 avoided is based on the Social Cost of Carbon estimated by President Obama's Interagency Working Group on the Social Cost of Carbon.

(e) The various social benefits of SO2 avoided were estimated with the Estimating Air pollution Social Impact Using Regression (EASIUR) model. PJM reflects the average benefit in Maryland, central. New England reflects the average benefit in Maine, northern.

(f) The various social benefits of NOx avoided were estimated with the EASIUR model. PJM reflects the average benefit in Maryland, central. New England reflects the average benefit in Maine, northern.

Figure 11. How REC Equity Works: An Example Investment [a]

($ in '000)	Equity Investment	Project Year 1	2	3	4	5 . . .	20	IRR (b)	Comment
Sponsor Ask:									
SREC Price ($/MWh)		$140	$140	$140	$140	$140	$140		• Sponsor asks for a price
Annual Generation (MWh) (c)		62,000	61,690	61,380	61,070	60,760	56,110		of $140/MWh for SRECs
SREC Sales		$8,680	$8,637	$8,593	$8,550	$8,506	$7,855		to achieve a 20% IRR
Distributions to Sponsor (d)	($16,000)	$2,051	$5,716	$5,754	$2,513	$58	$5,279	20.3%	
Offtaker Bid:									
SREC Price ($/MWh)		$135	$135	$135	$135	$135	$135		• Offtaker's maximum
MWh		62,000	61,690	61,380	61,070	60,760	56,110		willingness to pay of
SREC Sales		$8,370	$8,328	$8,286	$8,244	$8,203	$7,575		$135/MWh for SRECs
									drops the IRR below
Distributions to Sponsor	($16,000)	$1,741	$5,407	$5,447	$3,426	$55	$5,108	19.7%	the Sponsor's threshold
Bid-Ask Gap:									
SREC Price ($/MWh)		($5)	($5)	($5)	($5)	($5)	($5)		• REC Equity is designed to
Distributions to Sponsor		($310)	($308)	($307)	$913	($3)	($171)	(0.6%)	bridge this bid-ask gap
Negotiated Price:									
SREC Price ($/MWh)		$130	$130	$130	$130	$130	$130		• Unregulated Entity makes
MWh		62,000	61,690	61,380	61,070	60,760	56,110		an equity investment, but
SREC Sales		$8,060	$8,020	$7,979	$7,939	$7,899	$7,294		forgoes cash distributions
									in years 1 - 3 to enable
Distributions to Sponsor	($12,000)	$1,431	$5,099	$5,140	$367	$39	$3,703	20.1%	the Sponsor to achieve a
Distributions to Unregulated Entity (e)	($4,000)	$0	$0	$0	$12	$13	$1,234	10.3%	20% return
Offtaker Savings:									
Offtaker Bid ($/MWh)		$135	$135	$135	$135	$135	$135		• The Unregulated Entity's
Negotiated Price ($/MWh)		$130	$130	$130	$130	$130	$130		investment in the project
Offtaker Savings ($/MWh)		$5	$5	$5	$5	$5	$5		enables the Offtaker to
									to save $5/MWh (equal
Annual Generation (MWh) (c)		62,000	61,690	61,380	61,070	60,760	56,110		(to $281K–$310K/year
Offtaker Savings		$310	$308	$307	$305	$304	$281		based on annual MWh)
SREC Transfer:									
Forgone Cash Distribution?		Yes	Yes	Yes	No	No	No		• When the Unregulated
									Entity forgoes cash
Offtaker Savings		$310	$308	$307					distributions, the Offtaker
Negotiated Price ($/MWh)		$130	$130	$130					transfers a share of SRECs
SRECs Transferred (MWh equivalent) (f)		2,385	2,373	2,361					equal in value to the
									Offtaker savings, while
SRECs with Offtaker (MWh equivalent)		59,615	59,317	59,019	61,070	60,760	56,110		retaining other SRECs
Emissions Avoided:									
Maximum CO2 Avoided (tonnes)		50,000	49,750	49,501					• The Offtaker transfers
% SRECs Transferred		4%	4%	4%					SRECs equivalent to ~1,900
Unregulated Entity CO2 Avoided (tonnes)		1,923	1,913	1,904					tonnes of CO2 avoided

(a) A 20-year project model supports this analysis. This Figure shows Years 1–5 and Year 20 to simply the output. The 20-year model appears in the Appendix.
(b) The IRR are based on 20-years of cash flows.
(c) Assumes annual degradation of 0.5% based on NREL studies of degradation.
(d) Distributions reflect cash distributed based the sale of electricity and SRECs less operating expenses, debt service payments, contributions/redemptions to reserve accounts, and cash distributed to the tax equity investor based on the Partnership Agreement. Under the modeled Agreement, the Sponsor receives priority distributions until it recovers its initial investment (which accounts for the dropoff in Year 5).
(e) Distributions reflect cash distributed based the sale of electricity and SRECs less operating expenses, debt service payments, contributions/redemptions to reserve accounts, and cash distributed to the sponsor and tax equity investors based on the Partnership Agreement.
(f) The SRECs transferred represent only a portion of the total SRECs generated by the project. In this example, the offtaker transfers slightly less than 2,400 MWh of SRECs to the unregulated entity when it forgoes cash distributions, while retaining more than 59,000 MWh of SRECs. This way, over the life of the PPA, the offtaker still benefits from the savings enabled by the unregulated entity's investment, while the unregulated entity earns a return on its investment and receives SRECs to claim credit for reducing its carbon emissions.

Conclusion

Unregulated entities can tailor portfolios of renewable energy purchases and investments to match their carbon offset and co-benefits goals

Portfolio Recommendation

To maximize emission reductions and co-benefits, while minimizing cost, we recommend creating a portfolio that starts with REC Equity investments and then reinvests the returns from those projects in additional renewable energy purchases and investments. By starting with investments, the unregulated entity can create a portfolio that adds more green energy to the grid and reduces the unregulated entity's carbon emissions through a self-sustaining portfolio of purchases and investments that not only helps the unregulated entity achieve its goals, but also lowers the cost of renewable energy and drives innovation across the industry.

Portfolio Design Considerations

Creating a portfolio of renewable energy purchases and investments to achieve emissions reduction goals of 50,000 metric tons of CO_2 for an unregulated entity requires consideration of additionality, project location and technology, and procurement options. The REC procurement options selected for the portfolio can be tailored to the risk tolerance of the unregulated entity and its goals, prioritizing either Operational Excellence—proven structures and technologies—or Thought Leadership. Figure 12 summarizes the considerations that an unregulated entity should evaluate when designing its portfolio.

Figure 12. Renewable Energy Portfolio Considerations

	Operational Excellence		Thought Leadership
	Long-Term Unbundled REC Purchase Contract	Bundled REC Purchase Contract	REC Equity Investment
Additionality	Strict Financial Test		
Health and Co-Benefits	Dependent on Location, Technology, and Project Size		
Avoided CO_2 Target	Achievable with Purchases from Single Project		Requires Multiple Investments
Implementation	Market-Tested		Novel
Cost	Recurring		One-Time Upfront
Due Diligence	Limited	Moderate	High
Financial Impact	Expense	Hedge	Positive Return

Assessment of Tradeoffs between the Options

An unregulated entity that seeks to create carbon offsets through a portfolio of renewable energy purchases and investments will need to grapple with additionality considerations regardless of the REC procurement options selected. Across the options, we recommended a strict financial test. Similarly, the evaluation of health and other co-benefits will be equally dependent on location, technology, and project size for all of the options. Once these threshold factors are analyzed, the unregulated entity may customize its portfolio based on the following tradeoffs:

- **Avoided CO_2 Target:** Achieving the target reductions via Long-Term Unbundled or Bundled REC Purchases Contracts can be achieved with purchases from a single project in a selected region, but achieving the target solely through REC Equity would likely require multiple investments, increasing transaction costs for the entity.

- **Implementation:** Long-Term Unbundled or Bundled REC Purchases Contracts are both well-accepted procurement options that are market-tested, whereas REC Equity is a novel approach. Additionally, bundled REC purchases likely entail long contract durations, which may be undesirable for some unregulated entities.

- **Cost:** Unbundled and Bundled REC Purchase Contracts each entail recurring expenses. By contrast, a REC Equity investment represents a one-time upfront expenditure.

- **Due Diligence:** The due diligence is limited in the case of Long-term Unbundled REC Purchases and moderate for Bundled REC purchases, in which the projected costs of wholesale electricity rates must be considered. A REC Equity investment would require more due diligence to assess the project company and negotiate the various contracts that support the novel financial structure.

- **Financial Impact:** While Unbundled REC Purchases represent an expense, Bundled REC purchases can provide a hedge against electricity price fluctuations, potentially yielding lower-cost electricity in addition to RECs. By contrast, REC Equity investment is designed to provide a positive return on investment in the procurement of RECs to achieve emission offset goals.

After considering this tradeoffs, the unregulated entity can create a portfolio of renewable energy purchases and investments tailored to its values and environmental mission.

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Appendix:
Catalog of Potential Harms and Benefits Associated with Electricity Generation from Coal and Natural Gas Compared to Electricity Generation from Solar and Wind Energy

COAL & NATURAL GAS*

	COAL		NATURAL GAS	
Sector	**Impact**	**Pathway**	**Impact**	**Pathway**
Occupational				
Job Safety	• Human exposure to harmful substances • High occupational mortality rate	• Exposure to dust, black carbon, particulate matter, creates harmful work environments for coal miners. Over 200,000 coal miners have died of black lung disease since 1900.[i] • Since 1900, 100,000 people have died in coal mining accidents in the United States.[i]	• Human exposure to harmful chemicals • Exposure to air pollution • High occupational fatality rates • High risk of explosion	• By handling chemicals used in fracturing, workers are exposed to toxic substances, some of which are known carcinogens and methane.[ii] • Fracturing requires a lot of heavy equipment, most of which runs on diesel fuel, exposing workers to harmful particulates, hydrocarbons, and other pollutants, as well as noise and vibrations, which all have detrimental health effects, including certain cancers[ii] • Heavy equipment from pipeline installation, drilling, flaring, etc. emit air pollutants[ii] • Silica dust, a proppant during fracking, inhalation can cause silicosis, lung cancer, tuberculosis, kidney disease[ii] • Oil and gas occupations have a 2.5-7 times higher fatality rate than other similar industries[ii] • Natural gas reserves contain hydrogen sulfide, which carries a high explosion risk and is a central nervous system toxicant[ii]
Job Growth	• Small potential for job re-growth under the current Administration	• With the current United States administration, there is a small likelihood for increases in coal-related jobs in the near future • However, competitively priced natural gas and renewables, and increases in automation in the mining industry are removing coal-related jobs[iii]	• Potential for job growth • Jobs are for highly trained workers	• Estimates show that the number of jobs in natural gas should double by 2020 from 2014 levels[ii] • Most jobs are for highly trained workers, who are brought into sites from away, and are not usually local community members[iv] • However, with automated processes and competitively priced renewables, the evidence is unclear whether the growth potential will be fully realized.

* It was outside the scope of this report to include ways to mitigate harms and maximize benefits from coal and natural gas, as that cannot be done through the renewable energy projects.

	COAL		NATURAL GAS	
Sector	**Impact**	**Pathway**	**Impact**	**Pathway**
Water				
Groundwater, Fresh, and Surface Water Contamination	• Eutrophication of water bodies • Contamination of water sources harms organisms	• Phosphorous and nitrogen emitted from coal-burning power plants result in eutrophication of water sources[v] • Mercury that is emitted from coal-burning power plants is harmful to marine, terrestrial species[vi] • 20 of the chemicals used in coal slurries that pollute local water sources are known carcinogens, 24 associated with lung, heart disease[i,v]	• Risk of chemical contamination of fresh, surface and groundwater	• Many chemicals (e.g. silica, methanol, ethylene glycol, biocides, boron, benzene, toluene and many more) are utilized for fracturing as they are injecting into the ground wells.[ii,vii] • These chemicals, and leaking methane from drill sites, can contaminate the aquifer and surface waters if wells are leaky, spills occur, rocks are fractured, wells are abandoned, through drilling discharge, or through waste disposal.[ii]
Water Use	• Utilizes a large amount of water	• In order to operate a cooling system, a coal plant uses a small percent of the 70-180 billion gallons of water that is withdrawn each year[viii]	• Utilizes a large amount of water	• Hydraulic fracturing utilizes a large amount of water for injections into wells, anywhere from 2-10 million gallons of water per well, per fracture[ix]
Natural Resources				
Land Use and Degradation	• Requires a lot of land	• Deforestation and land degradation occur when coal-burning power plants are built. This occurs at a rate much larger than any renewable energy project.[ix] • This land use accounts for another large percent of greenhouse gases that is often not accounted for.[ix]	• Requires a lot of land • Land can be contaminated during fracturing	• Deforestation and land degradation occur when natural gas-burning power plants are built, as well as at fracturing site. Entire networks of fracturing wells are created, disrupting large areas of land[ix] • Chemical spills and leaks can result in soil contamination with harmful compounds[ii]
Waste Disposal	• Waste deposited in bodies of water	• Waste from coal mining and burning, which consists of heavy metals and other toxicants, can be buried in streams or put into slurries, which can leach into the water supply[i]	• Wastewater contains chemicals, radioactive materials, metals, and other harmful compounds	• Although the management of wastewater is monitored, protocol differs by state. In some places, wastewater can be inserted into the soil, stored underground, or re-injected in wells, leading to a potential for soil contamination.[ii,ix] • Wastewater injections can trigger earthquakes[x]
Wildlife	• Contamination of soil harms organisms	• Mercury that is emitted from coal-burning power plants is harmful to marine and terrestrial species within 15km of the power plant[vi] • Large amounts of water extraction can injure and kill marine species[viii]	• Negatively harm wildlife	• By inserting wastewater in soil or into wells, or inserting chemicals into the ground, with high potential for soil and water contamination, wildlife have been found to have acute and chronic metal toxicities in areas where fracturing is common[x]

	COAL		NATURAL GAS	
Sector	**Impact**	**Pathway**	**Impact**	**Pathway**
Environmental Justice				
Air Pollution	• High air pollution in the communities around coal-burning power plants and coal mines	• Typically, lower-income people tend to live in the most polluted areas, based on the economics of the housing market and other variables, increasing the health risks that these populations are already vulnerable to because of their socioeconomic status • Regions where coal is mined see the highest rates of all-cause mortality and lung cancer, heart- disease, respiratory, and kidney mortalities and a 16% greater odds of a baby being born with low birth weight.[i]	• Communities exposed to higher levels of air pollution • Family members of workers exposed to harmful chemicals • Emits methane, an even more potent greenhouse gas than carbon dioxide	• Fracturing requires a lot of heavy equipment, most of which runs on diesel fuel, exposing community members to harmful particulates, hydrocarbons, and other pollutants, as well as noise and vibrations, which all have detrimental health effects, including certain cancers[ii] • Workers can take fracturing chemicals and substances home on their clothes, shoes, skin and expose family members[ii] • Estimated that natural gas power plants emit 30% more methane than coal burning power plants and coal mines[xii] • Leaks from drilling sites release methane into the air, exposing workers and the surrounding populations, which can displace oxygen.[ii]

SOLAR

Sector	Impact	Pathway	How to Maximize Benefits & Reduce Harms
Occupational			
Job Safety	• Potential for occupational hazards if precautions are avoided	• Solar energy industry workers can be harmed via electric shock, falls, thermal burns, or arc flashes if proper protective equipment is not utilized. [xiii]	• Utilize personal protective equipment to ensure safety for all workers, regardless of sector of the industry • Increase safety procedures for solar workers to decrease risk injury
Job Growth	• Potential for job growth	• Workers who are highly trained will be employed at a higher rate than untrained workers[iii] • Reports show that the solar industry is hiring new workers much faster than the rest of the overall economy, although data is limited to fully assess this[iii]	• Provide job training to local residents to allow them to compete for jobs • Allow displaced workers, from coal- or natural gas-burning energy production units to receive this job training preferentially to prevent job losses • Improve employment tracking to monitor and evaluate job growth potential in the renewable energy sector
Water			
Surface and Groundwater Contamination	• Risk of surface water contamination	• Metals processing and refinement (e.g. copper, silicon) produces waste, and refuse that is thrown away can be discharged/runoff into surface water and contaminate surface water[v]	• Improve waste catchment from extraction and processing to prevent runoff or contamination • Provide sustainable waste removal or recycling of refuse
Fresh Water Contamination	• Eutrophication of nearby bodies of freshwater • Water contamination risk increases	• Metals extraction to make panels can result in eutrophication of water bodies[v] • Metals processing and refinement and panel refuse produces waste that can be discharged/runoff into surface water or spill and contaminate surface water[v]	• Provide sustainable waste removal or recycling of refuse • Improve waste catchment from extraction and processing to prevent runoff or contamination
Natural Resources			
Land Use and Degradation	• Requires a moderate amount of land that is relatively flat, and receives ample incoming solar radiation • Innovative installation provides opportunity to re-purpose land	• Although land is needed to build solar projects, it is estimated that solar projects currently reduces energy land use by 40-63% compared to a coal-burning power plant today.[v] However, this is likely an underestimate, as this estimate does not account for land occupied by coal mines.	• Pursue projects that do not require deforestation, and make use of already cleared space and/or rooftops • Re-purpose preexisting spaces (like covering parking lots) to allow for innovative design of solar projects, while keeping the original use of the space fully in tact • Avoid disrupting disadvantaged communities or natural ecosystems to integrate solar projects.

Sector	Impact	Pathway	How to Maximize Benefits & Reduce Harms
Mineral Extraction	• Over-extraction of minerals	• Metals extraction (e.g. copper, silicon, silver, cadmium, tellurium, selenium, etc.) to make photovoltaic panels, wiring, inverters, transformers, and mounts can result in over extraction of precious minerals that is 2-3 times current levels[v,ix] Over-extraction of minerals is harmful to biodiverse ecosystem, can lead to ground sinkholes, water pollution, and erosion.	• Obtain materials in sustainable ways • Prefer low-impact projects that are using fewer minerals per panel and are more efficient • Encourage research that study the efficiency of alternative materials in solar projects and improves panel efficiency
Waste Disposal	• Harmful exposures from photovoltaic panel waste disposal	• Metals processing and refinement (e.g. copper, silicon) produces waste, or panel refuse that can spill or is thrown away can be discharged/runoff into surface water, causing ecotoxicity of terrestrial and marine species.[vi]	• Recycle and reuse pieces that are not used • Allow for recycling and reuse of parts after a project has reached its full lifespan • Avoid projects that result in waste being disposed of in locations where disadvantaged communities or natural ecosystem are located
Wildlife	• Displacement of and harm to wildlife	• Depending on the location of project and the species found in that geographic region, the clearing of land for photovoltaic panels or access roads could harm or displace animals, plants, and other essential organisms[vi]	• Utilize spatial planners and environmental experts to conduct an environmental impact assessment of best practices and locations for project placement.
Environmental Justice			
Air Pollution	• Some potential for increases in local air pollution • Large potential for decreases in local and regional air pollution	• During construction, local air pollution increases from heavy equipment emitting diesel particles, dust from excavation and building of projects • However, by increasing solar energy, there can be a decrease in coal and natural gas powered energy, which reduces air pollution from particulate matter, sulfur dioxide, and nitrogen oxides in the region • When displacing natural gas powered energy, there is a decrease in methane leaks, leading to decreases in methane in the environment that is harmful to human health and is a potent greenhouse gas.	• Utilize construction companies that prefer more energy efficient equipment • Avoid projects where heavy construction would occur in disadvantaged communities • Choose solar projects that maximize emissions reductions

Sector	Impact	Pathway	How to Maximize Benefits & Reduce Harms
Energy Security	• Improve energy security for disadvantaged communities • Potential increase in transaction costs for others	• By financing renewable energy projects in low-income or extremely remote communities, the community can gain access to secure and stable electricity, improving overall quality of life[xiv] • Assuming transmission infrastructure remains the same, as more renewable energy is added to the grid, fewer people are left paying for the transmission and distribution of energy, which can result in higher energy bills for those left behind.	• Partner and collaborate with local organizations to prioritize disadvantaged communities and finance projects that would improve energy security of a population • Review projects recommended by Team 1, 2, and 3 to learn about specific opportunities available to further reduce greenhouse gas emissions • When possible, invest in transmission and distribution to ensure equity in energy access for all. • As renewable projects are added to the grid, work with utility policy makers to account for increases in transmission costs through fees or surcharges.
Education			
On-Campus Education	• Improve awareness and understanding of solar energy for students • Creation of multi-disciplinary research projects for students and faculty	• With new projects in place to reduce greenhouse gas emissions, the unregulated entity can incorporate lessons learned and hands-on learning for students of many disciplines • Students and faculty would have the ability to conduct research projects around the investment in, development of, and evaluation of various solar energy investments. For example, a graduate student from the unregulated entity's school of public health can conduct the Health Impact Assessment for the geographic locations of choice.	• Incorporate the following opportunities (non-exhaustive list) into educational settings: ○ Financing and structuring solar projects ○ Maximizing co-benefits from solar projects and conducting Health Impact Assessments ○ Monitoring and evaluating solar projects ○ Inspiring local climate action with unregulated entity greenhouse gas reductions
Off-Campus Education	• Improve understanding of solar energy for local residents and communities • Inspire other unregulated entities to follow and implement renewable energy projects of their own • Enhance job training for local residents	• With new projects in place to reduce greenhouse gas emissions, the unregulated entity can incorporate lessons learned and hands-on learning for community members and job-training exercises • By voluntarily reducing carbon dioxide emissions, the unregulated entity sets an example for leadership that other entities will likely follow	• Provide job training and/or internships for local residents to enhance their personal skill sets • Offer community visitation days or open-house events where community members can learn about the unregulated entities journey towards carbon neutrality • Provide public and transparent reports of the available projects and funding schemes, as well as implementation plans, to allow others to follow

WIND

Sector	Impact	Pathway	How to Maximize Benefits & Reduce Harms
Occupational			
Job Safety	• Potential for occupational hazards if precautions are avoided	• Although some reports show that there are injuries and deaths associated with wind farm workers, those are usually caused by the operation of heavy equipment, moving objects, hand-held tools, vehicles, or electric shock, which are not specific to the wind industry[xv,xvi]	• Utilize personal protective equipment to ensure safety for all workers, regardless of sector of the industry • Increase safety procedures for turbine workers to decrease risk of falling or other harms
Job Growth	• Potential for job growth	• Workers who are highly trained will be employed at a higher rate than untrained workers[iii]	• Provide job training to local residents to allow them to compete for jobs • Allow displaced workers, from coal- or natural gas-burning energy production units to receive this job training preferentially to prevent job losses • Improve employment tracking to monitor and evaluate job growth potential in the renewable energy sector
Water			
Fresh, Surface, Groundwater Contamination	• Small potential for water contamination	• Heavy equipment used in the construction of wind farms may contaminate water sources if a spill of fuel or other unintended action occurs	• Use protocol to ensure that spills, and other accidents, are avoided as much as possible
Natural Resources			
Land Use and Degradation	• Utilizes a moderate amount of land area	• Land is required for turbine siting, and the amount needed grows with the number of turbines. Land is also needed for roads and infrastructure to support the project[vi]	• Prioritize projects where the land utilized can still serve is primary purpose once the turbine is built (i.e. crops can still be grown on agricultural or marginal land where turbines are located) • Coordinate with developer to ensure that infrastructure for the project enhances the land, allowing for greater use after construction (i.e. construction of permanent roads, drainage systems, greater accessibility)
Waste Disposal	• In the future, a lot of waste will be produced	• As today's turbines reach the end of their life, they will be disposed of, and today they are mostly just sent to landfills[xvii] • Across the world, it is expected that there will be 50,000 tons of waste by 2020[xvii]	• Prioritize developers who sustainably source, recycle, and dispose of materials • Partner with companies that are collecting old blades, cutting them down, and refining them to be repurposes as composite materials for new blades

Sector	Impact	Pathway	How to Maximize Benefits & Reduce Harms
Wildlife	• May disrupt some wildlife	• Although wind turbines are thought to kill birds, bats, and other wildlife, this actually occurs at a much lower rate than fossil-fuel burning power plants, airplanes, other animals, and vehicles[xviii] • Depending on the location of project and the species found in that geographic region, the clearing of land for photovoltaic panels or access roads could harm or displace animals, plants, and other essential organisms[vi]	• Utilize spatial planners and environmental experts to conduct an environmental impact assessment of best practices and locations for project placement to protect wildlife • Ensure that once the turbine is built, the land can be utilized for its original purpose (agriculture, recreation, wildlife) so that natural ecosystems are restored
Environmental Justice			
Air Pollution	• Some potential for increases in local air pollution • Large potential for decreases in local and regional air pollution	• During construction, local air pollution increases from heavy equipment emitting diesel particles, dust from excavation and building of turbines • However, by increasing wind energy, there can be a decrease in coal and natural gas powered energy, which reduces air pollution from particulate matter, sulfur dioxide, and nitrogen oxides in the region • When displacing natural gas powered energy, there is a decrease in methane leaks, leading to decreases in methane in the environment that is harmful to human health and is a potent greenhouse gas.	• Utilize construction companies that prefer more energy efficient equipment • Avoid projects where heavy construction would occur in disadvantaged communities • Choose wind projects that maximize emissions reductions
Energy Security	• Improve energy security for disadvantaged communities • Potential increase in transaction costs for others	• By financing renewable energy projects for low-income or extremely remote communities, the community can gain access to secure and stable electricity, improving overall quality of life[xiv] • As more renewable energy is added to the grid, fewer people are left paying for the transmission and distribution of energy, which can result in higher energy bills for those left behind.	• Partner and collaborate with local organizations to prioritize disadvantaged communities and finance projects that would improve energy security of a population • Review projects recommended by Team 1, 2, and 3 to learn about specific opportunities available to further reduce greenhouse gas emissions • When possible, invest in transmission and distribution to ensure equity in energy access for all.
Education			

On-Campus Education	• Improve awareness and understanding of solar energy for students
	• Creation of multi-disciplinary research projects for students and faculty
		• With new projects in place to reduce greenhouse gas emissions, the unregulated entity can incorporate lessons learned and hands-on learning for students of many disciplines
		• Students and faculty would have the ability to conduct research projects around the investment
			• Incorporate the following opportunities (non-exhaustive list) into educational settings:
			  ○ Financing and structuring solar projects
			  ○ Maximizing co-benefits from solar projects and conducting Health Impact Assessments
			  ○ Monitoring and evaluating solar projects

Sector	Impact	Pathway	How to Maximize Benefits & Reduce Harms
		in, development of, and evaluation of various wind energy investments. For example, a graduate student from the unregulated entity's school of public health can conduct the Health Impact Assessment for the geographic locations of choice.	○ Inspiring local climate action with unregulated entity greenhouse gas reductions
Off-Campus Education	• Improve understanding of wind energy for local residents and communities • Inspire other unregulated entities to follow and implement renewable energy projects of their own • Enhance job training for local residents	• With new projects in place to reduce greenhouse gas emissions, the unregulated entity can incorporate lessons learned and hands-on learning for community members and job-training exercises • By voluntarily reducing carbon dioxide emissions, the unregulated entity sets an example for leadership that other entities will likely follow	• Provide job training and/or internships for local residents to enhance their personal skill sets • Offer community visitation days or open-house events where community members can learn about the unregulated entities journey towards carbon neutrality • Provide public and transparent reports of the available projects and funding schemes, as well as implementation plans, to allow others to follow

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Appendix:
PJM Solar Project Model

Key Inputs		Inputs
Project Assumptions:		
Renewable Energy Source		Utility PV
Nameplate Capacity (kW)		40,000
Installed Cost ($/W)		$2.00
Total Installation Cost ($)		$80,000,000
PPA Rate ($/kWh)		$0.075
SREC Price with SREC Equity ($/kWh)		$0.130
Financing Assumptions:		
Bank Debt	40.00%	$32,000,000
Tax Equity	40.00%	32,000,000
Sponsor Equity	15.00%	12,000,000
SREC Equity	5.00%	4,000,000
Total Installation Cost	100.00%	$80,000,000

Project Year	Input	0	1	2	3	4	5	6	7	8	9	10
Offtaker Savings												
PPA Rate ($/kWh)	$0.075		$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075
SREC Price without SREC Equity ($/kWh)	$0.135		$0.135	$0.135	$0.135	$0.135	$0.135	$0.135	$0.135	$0.135	$0.135	$0.135
SREC Price with SREC Equity ($/kWh)	$0.130		$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130
Annual Generation (kWh)			62,000,000	61,690,000	61,380,000	61,070,000	60,760,000	60,450,000	60,140,000	59,830,000	59,520,000	59,210,000
PPA Rate Payment			$4,650,000	$4,626,750	$4,603,500	$4,580,250	$4,557,000	$4,533,750	$4,510,500	$4,487,250	$4,464,000	$4,440,750
SREC Payment without SREC Equity			8,370,000	8,328,150	8,286,300	8,244,450	8,202,600	8,160,750	8,118,900	8,077,050	8,035,200	7,993,350
Offtaker Payments to Project Compay			$13,020,000	$12,954,900	$12,889,800	$12,824,700	$12,759,600	$12,694,500	$12,629,400	$12,564,300	$12,499,200	$12,434,100
SREC Payment with SREC Equity			8,060,000	8,019,700	7,979,400	7,939,100	7,898,800	7,858,500	7,818,200	7,777,900	7,737,600	7,697,300
Offtaker Payments to Project Entity			$12,710,000	$12,646,450	$12,582,900	$12,519,350	$12,455,800	$12,392,250	$12,328,700	$12,265,150	$12,201,600	$12,138,050
Offtaker Savings with SREC Equity			$310,000	$308,450	$306,900	$305,350	$303,800	$302,250	$300,700	$299,150	$297,600	$296,050
Project Cash Flow												
Key Inputs:												
Nameplate Capacity (kW)	40,000		40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Capacity Factor	17.69%		17.69%	17.69%	17.69%	17.69%	17.69%	17.69%	17.69%	17.69%	17.69%	17.69%
Production Degradation	0.50%		100.00%	99.50%	99.00%	98.50%	98.00%	97.50%	97.00%	96.50%	96.00%	95.50%
Annual Generation (kWh)	62,000,000		62,000,000	61,690,000	61,380,000	61,070,000	60,760,000	60,450,000	60,140,000	59,830,000	59,520,000	59,210,000
PPA Rate ($/kWh)	$0.075		$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075
PPA Escalation Factor	0.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SREC Price ($/kWh)	$0.275		$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130
Inflation Factor	1.50%		0.00%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
Project Cash Flow:												
Electricity Sales			$4,650,000	$4,626,750	$4,603,500	$4,580,250	$4,557,000	$4,533,750	$4,510,500	$4,487,250	$4,464,000	$4,440,750
REC Sales			8,060,000	8,019,700	7,979,400	7,939,100	7,898,800	7,858,500	7,818,200	7,777,900	7,737,600	7,697,300
Project Revenue			**12,710,000**	**12,646,450**	**12,582,900**	**12,519,350**	**12,455,800**	**12,392,250**	**12,328,700**	**12,265,150**	**12,201,600**	**12,138,050**
$/kWh			*$0.205*	*$0.205*	*$0.205*	*$0.205*	*$0.205*	*$0.205*	*$0.205*	*$0.205*	*$0.205*	*$0.205*
Fixed O&M	640,000		(640,000)	(649,600)	(659,344)	(669,234)	(679,273)	(689,462)	(699,804)	(710,301)	(720,955)	(731,770)
Site Control	640,000		(640,000)	(649,600)	(659,344)	(669,234)	(679,273)	(689,462)	(699,804)	(710,301)	(720,955)	(731,770)
Insurance	240,000		(240,000)	(243,600)	(247,254)	(250,963)	(254,727)	(258,548)	(262,426)	(266,363)	(270,358)	(274,414)
Property Taxes	400,000		(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)
Asset Management Services	640,000		(640,000)	(649,600)	(659,344)	(669,234)	(679,273)	(689,462)	(699,804)	(710,301)	(720,955)	(731,770)
Operating Expenses	$2,560,000		**(2,560,000)**	**(2,598,400)**	**(2,637,376)**	**(2,676,937)**	**(2,717,091)**	**(2,757,847)**	**(2,799,215)**	**(2,841,203)**	**(2,883,821)**	**(2,927,078)**
$/kWh			*$0.041*	*$0.042*	*$0.043*	*$0.044*	*$0.045*	*$0.046*	*$0.047*	*$0.047*	*$0.048*	*$0.049*
EBITDA			**10,150,000**	**10,048,050**	**9,945,524**	**9,842,413**	**9,738,709**	**9,634,403**	**9,529,485**	**9,423,947**	**9,317,779**	**9,210,972**
D&A			(27,448,212)	(5,597,292)	(3,515,397)	(2,261,100)	(2,246,907)	(1,305,032)	(369,976)	(369,976)	(370,161)	(543,136)
Interest Expense			(1,368,000)	(1,224,000)	(1,080,000)	(936,000)	(792,000)	(648,000)	(504,000)	(360,000)	(216,000)	(72,000)
Taxable Income (Loss)			**(18,666,212)**	**3,226,758**	**5,350,127**	**6,645,314**	**6,699,802**	**7,681,371**	**8,655,509**	**8,693,971**	**8,731,618**	**8,595,835**

Project Year	11	12	13	14	15	16	17	18	19	20
Offtaker Savings										
PPA Rate ($/kWh)	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075
SREC Price without SREC Equity ($/kWh)	$0.135	$0.135	$0.135	$0.135	$0.135	$0.135	$0.135	$0.135	$0.135	$0.135
SREC Price with SREC Equity ($/kWh)	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130
Annual Generation (kWh)	58,900,000	58,590,000	58,280,000	57,970,000	57,660,000	57,350,000	57,040,000	56,730,000	56,420,000	56,110,000
PPA Rate Payment	$4,417,500	$4,394,250	$4,371,000	$4,347,750	$4,324,500	$4,301,250	$4,278,000	$4,254,750	$4,231,500	$4,208,250
SREC Payment without SREC Equity	7,951,500	7,909,650	7,867,800	7,825,950	7,784,100	7,742,250	7,700,400	7,658,550	7,616,700	7,574,850
Offtaker Payments to Project Compay	$12,369,000	$12,303,900	$12,238,800	$12,173,700	$12,108,600	$12,043,500	$11,978,400	$11,913,300	$11,848,200	$11,783,100
SREC Payment with SREC Equity	7,657,000	7,616,700	7,576,400	7,536,100	7,495,800	7,455,500	7,415,200	7,374,900	7,334,600	7,294,300
Offtaker Payments to Project Entity	$12,074,500	$12,010,950	$11,947,400	$11,883,850	$11,820,300	$11,756,750	$11,693,200	$11,629,650	$11,566,100	$11,502,550
Offtaker Savings with SREC Equity	$294,500	$292,950	$291,400	$289,850	$288,300	$286,750	$285,200	$283,650	$282,100	$280,550
Project Cash Flow										
Key Inputs:										
Nameplate Capacity (kW)	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Capacity Factor	17.69%	17.69%	17.69%	17.69%	17.69%	17.69%	17.69%	17.69%	17.69%	17.69%
Production Degradation	95.00%	94.50%	94.00%	93.50%	93.00%	92.50%	92.00%	91.50%	91.00%	90.50%
Annual Generation (kWh)	58,900,000	58,590,000	58,280,000	57,970,000	57,660,000	57,350,000	57,040,000	56,730,000	56,420,000	56,110,000
PPA Rate ($/kWh)	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075	$0.075
PPA Escalation Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SREC Price ($/kWh)	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130	$0.130
Inflation Factor	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
Project Cash Flow:										
Electricity Sales	$4,417,500	$4,394,250	$4,371,000	$4,347,750	$4,324,500	$4,301,250	$4,278,000	$4,254,750	$4,231,500	$4,208,250
REC Sales	7,657,000	7,616,700	7,576,400	7,536,100	7,495,800	7,455,500	7,415,200	7,374,900	7,334,600	7,294,300
Project Revenue	**12,074,500**	**12,010,950**	**11,947,400**	**11,883,850**	**11,820,300**	**11,756,750**	**11,693,200**	**11,629,650**	**11,566,100**	**11,502,550**
$/kWh	*$0.205*	*$0.205*	*$0.205*	*$0.205*	*$0.205*	*$0.205*	*$0.205*	*$0.205*	*$0.205*	*$0.205*
Fixed O&M	(742,746)	(753,887)	(765,196)	(776,674)	(788,324)	(800,149)	(812,151)	(824,333)	(836,698)	(849,248)
Site Control	(742,746)	(753,887)	(765,196)	(776,674)	(788,324)	(800,149)	(812,151)	(824,333)	(836,698)	(849,248)
Insurance	(278,530)	(282,708)	(286,948)	(291,253)	(295,621)	(300,056)	(304,557)	(309,125)	(313,762)	(318,468)
Property Taxes	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)
Asset Management Services	(742,746)	(753,887)	(765,196)	(776,674)	(788,324)	(800,149)	(812,151)	(824,333)	(836,698)	(849,248)
Operating Expenses	**(2,970,985)**	**(3,015,549)**	**(3,060,783)**	**(3,106,694)**	**(3,153,295)**	**(3,200,594)**	**(3,248,603)**	**(3,297,332)**	**(3,346,792)**	**(3,396,994)**
$/kWh	*$0.050*	*$0.051*	*$0.053*	*$0.054*	*$0.055*	*$0.056*	*$0.057*	*$0.058*	*$0.059*	*$0.061*
EBITDA	**9,103,515**	**8,995,401**	**8,886,617**	**8,777,156**	**8,667,005**	**8,556,156**	**8,444,597**	**8,332,318**	**8,219,308**	**8,105,556**
D&A	(717,001)	(716,494)	(716,678)	(716,494)	(716,678)	(554,707)	(392,920)	(392,920)	(392,920)	(566,080)
Interest Expense	0	0	0	0	0	0	0	0	0	0
Taxable Income (Loss)	**8,386,515**	**8,278,907**	**8,169,939**	**8,060,662**	**7,950,327**	**8,001,449**	**8,051,677**	**7,939,398**	**7,826,388**	**7,539,476**

Project Year	Input	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Distributions Waterfall																						
Distributable Cash:																						
Revenue			$12,710,000	$12,646,450	$12,582,900	$12,519,350	$12,455,800	$12,392,250	$12,328,700	$12,265,150	$12,201,600	$12,138,050	$12,074,500	$12,010,950	$11,947,400	$11,883,850	$11,820,300	$11,756,750	$11,693,200	$11,629,650	$11,566,100	$11,502,550
Operating Expenses			(2,560,000)	(2,598,400)	(2,637,376)	(2,676,937)	(2,717,091)	(2,757,847)	(2,799,215)	(2,841,203)	(2,883,821)	(2,927,078)	(2,970,985)	(3,015,549)	(3,060,783)	(3,106,694)	(3,153,295)	(3,200,594)	(3,248,603)	(3,297,332)	(3,346,792)	(3,396,994)
Interest Expense			(1,368,000)	(1,224,000)	(1,080,000)	(936,000)	(792,000)	(648,000)	(504,000)	(360,000)	(216,000)	(72,000)	0	0	0	0	0	0	0	0	0	0
Principal Repayment			(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	0	0	0	0	0	0	0	0	0	0
DSRA (Contribution) / Redemption			(2,284,000)	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	1,636,000	0	0	0	0	0	0	0	0	0
O&M/Working Reserve Account (Contribution) / Redemption			(1,289,600)	(19,344)	(19,634)	(19,929)	(20,228)	(20,531)	(20,839)	(21,152)	(21,469)	(21,791)	(22,118)	(22,450)	(22,786)	(23,128)	(23,475)	(23,827)	(24,184)	(24,547)	(24,915)	(12,550)
MMRA (Contribution) / Redemption			(577,778)	(577,778)	(577,778)	(577,778)	(577,778)	(577,778)	(577,778)	(577,778)	(577,778)	5,200,000	(577,778)	(577,778)	(577,778)	(577,778)	(577,778)	(577,778)	(577,778)	(577,778)	(577,778)	5,200,000
Major Maintenance			0	0	0	0	0	0	0	0	0	(5,200,000)	0	0	0	0	0	0	0	0	0	(5,200,000)
Cash Available for Distrbution pre-Cash Minimum			1,430,622	5,098,928	5,140,112	5,180,707	5,220,704	5,260,094	5,298,868	5,337,018	5,374,532	5,989,181	10,139,620	8,395,173	8,286,053	8,176,250	8,065,753	7,954,551	7,842,635	7,729,993	7,616,615	8,093,006
Cash Reserve (Contribution) / Redemption			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Available for Distribution before Cash Sweep			1,430,622	5,098,928	5,140,112	5,180,707	5,220,704	5,260,094	5,298,868	5,337,018	5,374,532	5,989,181	10,139,620	8,395,173	8,286,053	8,176,250	8,065,753	7,954,551	7,842,635	7,729,993	7,616,615	8,093,006
Cumulative			*1,430,622*	*6,529,550*	*11,669,663*	*16,850,369*	*22,071,073*	*27,331,168*	*32,630,036*	*37,967,054*	*43,341,586*	*49,330,767*	*59,470,387*	*67,865,560*	*76,151,614*	*84,327,864*	*92,393,616*	*100,348,167*	*108,190,802*	*115,920,795*	*123,537,410*	*131,630,415*
Cash Sweep to SEI			1,430,622	5,098,928	5,140,112	330,337	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Availdable for Distribution after Cash Sweep			0	0	0	4,850,369	5,220,704	5,260,094	5,298,868	5,337,018	5,374,532	5,989,181	10,139,620	8,395,173	8,286,053	8,176,250	8,065,753	7,954,551	7,842,635	7,729,993	7,616,615	8,093,006
Distributions:																						
Allocation after Cash Sweep																						
Tax Equity Investor			99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%
Sponsor Equity Investor			0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%
SREC Equity Investor			0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%
Tax Equity Investor	$32,000,000		0	0	0	4,801,866	5,168,497	5,207,493	5,245,880	2,081,437	2,096,068	2,335,781	3,954,452	3,274,118	3,231,561	3,188,737	3,145,644	3,102,275	3,058,628	3,014,697	2,970,480	3,156,272
Sponsor Equity Investor	$12,000,000		1,430,622	5,098,928	5,140,112	366,715	39,155	39,451	39,742	2,441,686	2,458,849	2,740,050	4,638,876	3,840,792	3,790,869	3,740,634	3,690,082	3,639,207	3,588,005	3,536,472	3,484,601	3,702,550
SREC Equity Investor	$4,000,000		0	0	0	12,126	13,052	13,150	13,247	813,895	819,616	913,350	1,546,292	1,280,264	1,263,623	1,246,878	1,230,027	1,213,069	1,196,002	1,178,824	1,161,534	1,234,183
Reserve Accounts:																						
BoP DSRA			$0	$2,284,000	$2,212,000	$2,140,000	$2,068,000	$1,996,000	$1,924,000	$1,852,000	$1,780,000	$1,708,000	$1,636,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Contribution			2,284,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Redemption			0	(72,000)	(72,000)	(72,000)	(72,000)	(72,000)	(72,000)	(72,000)	(72,000)	(72,000)	(1,636,000)	0	0	0	0	0	0	0	0	0
EoP DSRA		$0	$2,284,000	$2,212,000	$2,140,000	$2,068,000	$1,996,000	$1,924,000	$1,852,000	$1,780,000	$1,708,000	$1,636,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
BoP O&M/WC Reserve Account			$0	$1,289,600	$1,308,944	$1,328,578	$1,348,507	$1,368,734	$1,389,265	$1,410,104	$1,431,256	$1,452,725	$1,474,516	$1,496,633	$1,519,083	$1,541,869	$1,564,997	$1,588,472	$1,612,299	$1,636,484	$1,661,031	$1,685,946
Contribution			1,289,600	19,344	19,634	19,929	20,228	20,531	20,839	21,152	21,469	21,791	22,118	22,450	22,786	23,128	23,475	23,827	24,184	24,547	24,915	12,550
Redemption			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EoP O&M/WC Reserve Account		$0	$1,289,600	$1,308,944	$1,328,578	$1,348,507	$1,368,734	$1,389,265	$1,410,104	$1,431,256	$1,452,725	$1,474,516	$1,496,633	$1,519,083	$1,541,869	$1,564,997	$1,588,472	$1,612,299	$1,636,484	$1,661,031	$1,685,946	$1,698,497
BoP MMRA			$0	$577,778	$1,155,556	$1,733,333	$2,311,111	$2,888,889	$3,466,667	$4,044,444	$4,622,222	$5,200,000	$0	$577,778	$1,155,556	$1,733,333	$2,311,111	$2,888,889	$3,466,667	$4,044,444	$4,622,222	$5,200,000
Contribution			577,778	577,778	577,778	577,778	577,778	577,778	577,778	577,778	577,778	0	577,778	577,778	577,778	577,778	577,778	577,778	577,778	577,778	577,778	0
Redemption			0	0	0	0	0	0	0	0	0	(5,200,000)	0	0	0	0	0	0	0	0	0	(5,200,000)
EoP MMRA		$0	$577,778	$1,155,556	$1,733,333	$2,311,111	$2,888,889	$3,466,667	$4,044,444	$4,622,222	$5,200,000	$0	$577,778	$1,155,556	$1,733,333	$2,311,111	$2,888,889	$3,466,667	$4,044,444	$4,622,222	$5,200,000	$0
BoP Cash			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Contribution			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Redemption			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EoP Cash		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Bank Debt																						
Bank Debt Terms:																						
Bank Debt	$32,000,000																					
Tenor (yr)	10.0																					
Interest Expense (L + 350)	4.50%																					
3M LIBOR	1.00%																					
DSRA Requirement (yr)	0.5																					
Debt Schedule:																						
BoP Balance			$0	$28,800,000	$25,600,000	$22,400,000	$19,200,000	$16,000,000	$12,800,000	$9,600,000	$6,400,000	$3,200,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Drawdown			$32,000,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment			(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	(3,200,000)	0	0	0	0	0	0	0	0	0	0
EoP Balance		$0	$28,800,000	$25,600,000	$22,400,000	$19,200,000	$16,000,000	$12,800,000	$9,600,000	$6,400,000	$3,200,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest Expense			$1,368,000	$1,224,000	$1,080,000	$936,000	$792,000	$648,000	$504,000	$360,000	$216,000	$72,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Principal Repayment			$3,200,000	$3,200,000	$3,200,000	$3,200,000	$3,200,000	$3,200,000	$3,200,000	$3,200,000	$3,200,000	$3,200,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest Expense			1,368,000	1,224,000	1,080,000	936,000	792,000	648,000	504,000	360,000	216,000	72,000	0	0	0	0	0	0	0	0	0	0
Debt Service		$0	$4,568,000	$4,424,000	$4,280,000	$4,136,000	$3,992,000	$3,848,000	$3,704,000	$3,560,000	$3,416,000	$3,272,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Project Year	Input	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Tax Equity																						
Tax Equity Inputs:																						
Tax Equity	$32,000,000																					
Total Installation Costs	$80,000,000																					
Eligible for ITC	90.00%																					
Installed Costs Eligible for ITC	$72,000,000																					
ITC	30.00%																					
ITC	$21,600,000																					
Flip Period	7																					
Pre-Flip Cash Flow to TEI	99.00%																					
Post-Flip Cash Flow to TEI	39.00%																					
Cash Flow Allocation:																						
Tax Equity Investor			99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%	39.00%
Sponsor Equity	$12,000,000		0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%	45.75%
SREC Equity	$4,000,000		0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%	15.25%
Capital Accounts:																						
TEI Capital Account																						
BoP Balance			$0	$2,828,450	$6,022,941	$11,319,566	$12,953,353	$14,417,661	$16,814,725	$20,137,799	$21,447,011	$22,756,274	$23,772,870	$23,089,159	$23,043,815	$22,998,530	$22,953,451	$22,908,435	$22,926,725	$23,008,252	$23,089,920	$23,171,731
Investor Contribution			32,000,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ITC Basis Reduction			(10,692,000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Chargeback Income			(18,479,550)	3,194,491	5,296,626	6,578,861	6,632,804	7,604,558	8,568,954	3,390,649	3,405,331	3,352,376	3,270,741	3,228,774	3,186,276	3,143,658	3,100,628	3,120,565	3,140,154	3,096,365	3,052,291	2,940,396
Chargeback Income			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Distributions			0	0	0	(4,801,866)	(5,168,497)	(5,207,493)	(5,245,880)	(2,081,437)	(2,096,068)	(2,335,781)	(3,954,452)	(3,274,118)	(3,231,561)	(3,188,737)	(3,145,644)	(3,102,275)	(3,058,628)	(3,014,697)	(2,970,480)	(3,156,272)
Interim Balance			2,828,450	6,022,941	11,319,566	13,096,561	14,417,661	16,814,725	20,137,799	21,447,011	22,756,274	23,772,870	23,089,159	23,043,815	22,998,530	22,953,451	22,908,435	22,926,725	23,008,252	23,089,920	23,171,731	22,955,855
Changes in Minimum Gain																						
Adjusted Interim Balance			2,828,450	6,022,941	11,319,566	13,096,561	14,417,661	16,814,725	20,137,799	21,447,011	22,756,274	23,772,870	23,089,159	23,043,815	22,998,530	22,953,451	22,908,435	22,926,725	23,008,252	23,089,920	23,171,731	22,955,855
Stop Loss Reallocations (from SEI and SRECEI to TEI)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stop Loss Reallocations (from TEI to SEI and SRECEI)			0	0	0	(143,208)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Excess Distributions Over Basis Step-Up			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EoP Balance		$0	$2,828,450	$6,022,941	$11,319,566	$12,953,353	$14,417,661	$16,814,725	$20,137,799	$21,447,011	$22,756,274	$23,772,870	$23,089,159	$23,043,815	$22,998,530	$22,953,451	$22,908,435	$22,926,725	$23,008,252	$23,089,920	$23,171,731	$22,955,855
SEI Capital Account																						
BoP Balance			$0	$10,348,381	$5,273,654	$173,668	$0	$11,093	$29,253	$54,428	$1,590,234	$3,126,100	$4,318,645	$3,516,599	$3,463,407	$3,410,285	$3,357,404	$3,304,597	$3,326,052	$3,421,689	$3,517,492	$3,613,463
Investor Contribution			12,000,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ITC Basis Reduction			(81,000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Chargeback Income			(139,997)	24,201	40,126	49,840	50,249	57,610	64,916	3,977,492	3,994,715	3,932,595	3,836,831	3,787,600	3,737,747	3,687,753	3,637,275	3,660,663	3,683,642	3,632,275	3,580,572	3,449,310
Chargeback Income			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Distributions			(1,430,622)	(5,098,928)	(5,140,112)	(366,715)	(39,155)	(39,451)	(39,742)	(2,441,686)	(2,458,849)	(2,740,050)	(4,638,876)	(3,840,792)	(3,790,869)	(3,740,634)	(3,690,082)	(3,639,207)	(3,588,005)	(3,536,472)	(3,484,601)	(3,702,550)
Interim Balance			10,348,381	5,273,654	173,668	(143,208)	11,093	29,253	54,428	1,590,234	3,126,100	4,318,645	3,516,599	3,463,407	3,410,285	3,357,404	3,304,597	3,326,052	3,421,689	3,517,492	3,613,463	3,360,224
Changes in Minimum Gain																						
Adjusted Interim Balance			10,348,381	5,273,654	173,668	(143,208)	11,093	29,253	54,428	1,590,234	3,126,100	4,318,645	3,516,599	3,463,407	3,410,285	3,357,404	3,304,597	3,326,052	3,421,689	3,517,492	3,613,463	3,360,224
Stop Loss Reallocations (from Sponsor to TEI)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stop Loss Reallocations (from TEI to Sponsor)			0	0	0	143,208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Excess Distributions Over Basis Step-Up			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EoP Balance		$0	$10,348,381	$5,273,654	$173,668	$0	$11,093	$29,253	$54,428	$1,590,234	$3,126,100	$4,318,645	$3,516,599	$3,463,407	$3,410,285	$3,357,404	$3,304,597	$3,326,052	$3,421,689	$3,517,492	$3,613,463	$3,360,224
SRECEI Capital Account																						
BoP Balance			$0	$3,926,334	$3,934,401	$3,947,777	$3,952,264	$3,955,962	$3,962,015	$3,970,407	$4,482,342	$4,994,298	$5,391,812	$5,124,464	$5,106,733	$5,089,026	$5,071,399	$5,053,796	$5,060,948	$5,092,827	$5,124,761	$5,156,752
Investor Contribution			4,000,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ITC Basis Reduction			(27,000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Chargeback Income			(46,666)	8,067	13,375	16,613	16,750	19,203	21,639	1,325,831	1,331,572	1,310,865	1,278,944	1,262,533	1,245,916	1,229,251	1,212,425	1,220,221	1,227,881	1,210,758	1,193,524	1,149,770
Chargeback Income			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Distributions			0	0	0	(12,126)	(13,052)	(13,150)	(13,247)	(813,895)	(819,616)	(913,350)	(1,546,292)	(1,280,264)	(1,263,623)	(1,246,878)	(1,230,027)	(1,213,069)	(1,196,002)	(1,178,824)	(1,161,534)	(1,234,183)
Interim Balance			3,926,334	3,934,401	3,947,777	3,952,264	3,955,962	3,962,015	3,970,407	4,482,342	4,994,298	5,391,812	5,124,464	5,106,733	5,089,026	5,071,399	5,053,796	5,060,948	5,092,827	5,124,761	5,156,752	5,072,339
Changes in Minimum Gain																						
Adjusted Interim Balance			3,926,334	3,934,401	3,947,777	3,952,264	3,955,962	3,962,015	3,970,407	4,482,342	4,994,298	5,391,812	5,124,464	5,106,733	5,089,026	5,071,399	5,053,796	5,060,948	5,092,827	5,124,761	5,156,752	5,072,339
Stop Loss Reallocations (from Sponsor to TEI)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stop Loss Reallocations (from TEI to Sponsor)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Excess Distributions Over Basis Step-Up			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EoP Balance		$0	$3,926,334	$3,934,401	$3,947,777	$3,952,264	$3,955,962	$3,962,015	$3,970,407	$4,482,342	$4,994,298	$5,391,812	$5,124,464	$5,106,733	$5,089,026	$5,071,399	$5,053,796	$5,060,948	$5,092,827	$5,124,761	$5,156,752	$5,072,339

Project Year	Input	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Tax Equity																						
Outside Basis:																						
TEI Tax Basis																						
BoP Basis			$0	$32,828,000	$43,068,000	$52,028,000	$54,906,134	$59,360,869	$66,877,933	$74,041,007	$77,910,219	$80,499,482	$81,516,078	$80,832,367	$80,787,023	$80,741,738	$80,696,659	$80,651,643	$80,669,933	$80,751,460	$80,833,128	$80,914,939
Equity Contribution			32,000,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Distributions			0	0	0	(4,801,866)	(5,168,497)	(5,207,493)	(5,245,880)	(2,081,437)	(2,096,068)	(2,335,781)	(3,954,452)	(3,274,118)	(3,231,561)	(3,188,737)	(3,145,644)	(3,102,275)	(3,058,628)	(3,014,697)	(2,970,480)	(3,156,272)
ITC Adjustment			(10,692,000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Taxable Income			0	3,194,491	5,296,626	6,578,861	6,632,804	7,604,558	8,568,954	3,390,649	3,405,331	3,352,376	3,270,741	3,228,774	3,186,276	3,143,658	3,100,628	3,120,565	3,140,154	3,096,365	3,052,291	2,940,396
Change in Share of Liabilities			11,520,000	10,240,000	8,960,000	7,680,000	6,400,000	5,120,000	3,840,000	2,560,000	1,280,000	0	0	0	0	0	0	0	0	0	0	0
Interim Basis			32,828,000	46,262,491	57,324,626	61,484,995	62,770,442	66,877,933	74,041,007	77,910,219	80,499,482	81,516,078	80,832,367	80,787,023	80,741,738	80,696,659	80,651,643	80,669,933	80,751,460	80,833,128	80,914,939	80,699,063
Excess Distributions			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Taxable Loss			(18,479,550)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interim Basis before Suspended Losses			14,348,450	46,262,491	57,324,626	61,484,995	62,770,442	66,877,933	74,041,007	77,910,219	80,499,482	81,516,078	80,832,367	80,787,023	80,741,738	80,696,659	80,651,643	80,669,933	80,751,460	80,833,128	80,914,939	80,699,063
Suspended Loss Generated			18,479,550	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Loss Used			0	(3,194,491)	(5,296,626)	(6,578,861)	(3,409,573)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EoP Basis		$0	32,828,000	43,068,000	52,028,000	54,906,134	59,360,869	66,877,933	74,041,007	77,910,219	80,499,482	81,516,078	80,832,367	80,787,023	80,741,738	80,696,659	80,651,643	80,669,933	80,751,460	80,833,128	80,914,939	80,699,063
BoP Carryforward			$0	$18,479,550	$15,285,059	$9,988,434	$3,409,573	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Addition			18,479,550	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Utilization			0	(3,194,491)	(5,296,626)	(6,578,861)	(3,409,573)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EoP Carryforward		$0	$18,479,550	$15,285,059	$9,988,434	$3,409,573	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SEI Tax Basis																						
BoP Basis			$0	$14,808,378	$13,549,450	$11,769,337	$14,282,622	$16,667,885	$18,606,045	$20,071,220	$22,567,026	$24,582,893	$25,775,437	$24,973,391	$24,920,200	$24,867,077	$24,814,196	$24,761,389	$24,782,845	$24,878,481	$24,974,284	$25,070,256
Equity Contribution			12,000,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Distributions			(1,430,622)	(5,098,928)	(5,140,112)	(366,715)	(39,155)	(39,451)	(39,742)	(2,441,686)	(2,458,849)	(2,740,050)	(4,638,876)	(3,840,792)	(3,790,869)	(3,740,634)	(3,690,082)	(3,639,207)	(3,588,005)	(3,536,472)	(3,484,601)	(3,702,550)
ITC Adjustment			(81,000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Taxable Income			0	24,201	40,126	49,840	50,249	57,610	64,916	3,977,492	3,994,715	3,932,595	3,836,831	3,787,600	3,737,747	3,687,753	3,637,275	3,660,663	3,683,642	3,632,275	3,580,572	3,449,310
Change in Share of Liabilities			4,320,000	3,840,000	3,360,000	2,880,000	2,400,000	1,920,000	1,440,000	960,000	480,000	0	0	0	0	0	0	0	0	0	0	0
Interim Basis			14,808,378	13,573,650	11,809,463	14,332,462	16,693,715	18,606,045	20,071,220	22,567,026	24,582,893	25,775,437	24,973,391	24,920,200	24,867,077	24,814,196	24,761,389	24,782,845	24,878,481	24,974,284	25,070,256	24,817,016
Excess Distributions			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Taxable Loss			(139,997)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interim Basis before Suspended Losses			14,668,381	13,573,650	11,809,463	14,332,462	16,693,715	18,606,045	20,071,220	22,567,026	24,582,893	25,775,437	24,973,391	24,920,200	24,867,077	24,814,196	24,761,389	24,782,845	24,878,481	24,974,284	25,070,256	24,817,016
Suspended Loss Generated			139,997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Loss Used			0	(24,201)	(40,126)	(49,840)	(25,830)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EoP Basis		$0	14,808,378	13,549,450	11,769,337	14,282,622	16,667,885	18,606,045	20,071,220	22,567,026	24,582,893	25,775,437	24,973,391	24,920,200	24,867,077	24,814,196	24,761,389	24,782,845	24,878,481	24,974,284	25,070,256	24,817,016
BoP Carryforward			$0	$139,997	$115,796	$75,670	$25,830	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Addition			139,997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Utilization			0	(24,201)	(40,126)	(49,840)	(25,830)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EoP Carryforward		$0	$139,997	$115,796	$75,670	$25,830	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SRECEI Tax Basis																						
BoP Basis			$0	$5,413,000	$6,693,000	$7,813,000	$8,760,874	$9,555,962	$10,202,015	$10,690,407	$11,522,342	$12,194,298	$12,591,812	$12,324,464	$12,306,733	$12,289,026	$12,271,399	$12,253,796	$12,260,948	$12,292,827	$12,324,761	$12,356,752
Equity Contribution			4,000,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Distributions			0	0	0	(12,126)	(13,052)	(13,150)	(13,247)	(813,895)	(819,616)	(913,350)	(1,546,292)	(1,280,264)	(1,263,623)	(1,246,878)	(1,230,027)	(1,213,069)	(1,196,002)	(1,178,824)	(1,161,534)	(1,234,183)
ITC Adjustment			(27,000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Taxable Income			0	8,067	13,375	16,613	16,750	19,203	21,639	1,325,831	1,331,572	1,310,865	1,278,944	1,262,533	1,245,916	1,229,251	1,212,425	1,220,221	1,227,881	1,210,758	1,193,524	1,149,770
Change in Share of Liabilities			1,440,000	1,280,000	1,120,000	960,000	800,000	640,000	480,000	320,000	160,000	0	0	0	0	0	0	0	0	0	0	0
Interim Basis			5,413,000	6,701,067	7,826,375	8,777,487	9,564,572	10,202,015	10,690,407	11,522,342	12,194,298	12,591,812	12,324,464	12,306,733	12,289,026	12,271,399	12,253,796	12,260,948	12,292,827	12,324,761	12,356,752	12,272,339
Excess Distributions			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Taxable Loss			(46,666)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interim Basis before Suspended Losses			5,366,334	6,701,067	7,826,375	8,777,487	9,564,572	10,202,015	10,690,407	11,522,342	12,194,298	12,591,812	12,324,464	12,306,733	12,289,026	12,271,399	12,253,796	12,260,948	12,292,827	12,324,761	12,356,752	12,272,339
Suspended Loss Generated			46,666	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Loss Used			0	(8,067)	(13,375)	(16,613)	(8,610)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EoP Basis		$0	5,413,000	6,693,000	7,813,000	8,760,874	9,555,962	10,202,015	10,690,407	11,522,342	12,194,298	12,591,812	12,324,464	12,306,733	12,289,026	12,271,399	12,253,796	12,260,948	12,292,827	12,324,761	12,356,752	12,272,339
BoP Carryforward			$0	$46,666	$38,599	$25,223	$8,610	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Addition			46,666	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Utilization			0	(8,067)	(13,375)	(16,613)	(8,610)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EoP Carryforward		$0	$46,666	$38,599	$25,223	$8,610	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Project Year	Input	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Returns Analysis																						
Tax Equity:																						
Investment		($32,000,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Tax Benefit	35.00%		0	13,952,243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Distributions			0	0	0	4,801,866	5,168,497	5,207,493	5,245,880	2,081,437	2,096,068	2,335,781	3,954,452	3,274,118	3,231,561	3,188,737	3,145,644	3,102,275	3,058,628	3,014,697	2,970,480	3,156,272
Net Cash Flow		($32,000,000)	$0	$13,952,243	$0	$4,801,866	$5,168,497	$5,207,493	$5,245,880	$2,081,437	$2,096,068	$2,335,781	$3,954,452	$3,274,118	$3,231,561	$3,188,737	$3,145,644	$3,102,275	$3,058,628	$3,014,697	$2,970,480	$3,156,272
Cumulative Cash Distributions		$40,986,126																				
Cash-on-Cash Return		1.3x																				
IRR		11.11%																				
Sponsor Equity:																						
Investment		($12,000,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cash Distributions			1,430,622	5,098,928	5,140,112	366,715	39,155	39,451	39,742	2,441,686	2,458,849	2,740,050	4,638,876	3,840,792	3,790,869	3,740,634	3,690,082	3,639,207	3,588,005	3,536,472	3,484,601	3,702,550
Net Cash Flow		($12,000,000)	$1,430,622	$5,098,928	$5,140,112	$366,715	$39,155	$39,451	$39,742	$2,441,686	$2,458,849	$2,740,050	$4,638,876	$3,840,792	$3,790,869	$3,740,634	$3,690,082	$3,639,207	$3,588,005	$3,536,472	$3,484,601	$3,702,550
Cumulative Cash Distributions		$45,447,399																				
Cash-on-Cash Return		3.8x																				
IRR		20.09%																				
Pro-Rata Purchase of SRECEI Stake			0	0	0	0	(58,509)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pro-Rata Additional Cash Flow			0	0	0	0	0	132	132	496,476	499,966	557,144	943,238	780,961	770,810	760,596	750,317	739,972	729,561	719,083	708,536	752,852
Payment from SEI to TEI to Maintain TEI IRR			0	0	0	0	0	(373,064)	(373,064)	(373,064)	(373,064)	(373,064)	(373,064)	(373,064)	(373,064)	(373,064)	(373,064)	(373,064)	(373,064)	(373,064)	(373,064)	(373,064)
Net Cash Flow with Buyout		(12,000,000)	1,430,622	5,098,928	5,140,112	366,715	(19,354)	(333,482)	(333,190)	2,565,098	2,585,751	2,924,130	5,209,050	4,248,689	4,188,616	4,128,166	4,067,335	4,006,115	3,944,503	3,882,491	3,820,073	4,082,338
Cumulative Cash Distributions		$49,002,706																				
Cash-on-Cash Return		4.1x																				
IRR		20.28%																				
SREC Equity:																						
Investment		($4,000,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cash Distributions			0	0	0	12,126	13,052	13,150	13,247	813,895	819,616	913,350	1,546,292	1,280,264	1,263,623	1,246,878	1,230,027	1,213,069	1,196,002	1,178,824	1,161,534	1,234,183
Offtaker Payments SRECEI			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Cash Flow		($4,000,000)	$0	$0	$0	$12,126	$13,052	$13,150	$13,247	$813,895	$819,616	$913,350	$1,546,292	$1,280,264	$1,263,623	$1,246,878	$1,230,027	$1,213,069	$1,196,002	$1,178,824	$1,161,534	$1,234,183
Cumulative Cash Distributions		$11,149,133																				
Cash-on-Cash Return		2.8x																				
IRR		10.28%																				
Depreciation Schedule																						
Key Inputs:																						
Total Installation Cost	$80,000,000																					
Non-Depreciable	4.0%																					
Depreciable Installation Cost	$76,800,000																					
Depreciation Schedule:																						
5 Year MACRS	70.0%		20.00%	32.00%	19.20%	11.52%	11.52%	5.76%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
7 Year MACRS	0.0%		14.29%	24.49%	17.49%	12.49%	8.93%	8.92%	8.93%	4.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15 Year MACRS	8.0%		5.00%	9.50%	8.55%	7.70%	6.93%	6.23%	5.90%	5.90%	5.91%	5.90%	5.91%	5.90%	5.91%	5.90%	5.91%	2.95%	0.00%	0.00%	0.00%	0.00%
20 Year MACRS	0.0%		3.75%	7.22%	6.68%	6.18%	5.71%	5.29%	4.89%	4.52%	4.46%	4.46%	4.46%	4.46%	4.46%	4.46%	4.46%	4.46%	4.46%	4.46%	4.46%	4.46%
5 Year SL	0.0%		10.00%	20.00%	20.00%	20.00%	20.00%	10.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15 Year SL	14.0%		3.33%	6.67%	6.67%	6.67%	6.67%	6.67%	6.67%	6.67%	6.67%	6.67%	6.67%	6.66%	6.66%	6.66%	6.66%	3.33%	0.00%	0.00%	0.00%	0.00%
20 Year SL	4.0%		2.50%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
39 Year SL	0.0%		1.28%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%	2.56%
Bonus Depreciation	30.0%		100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Annual Depreciation:																						
5 Year MACRS	$16,128,000		$3,225,600	$5,160,960	$3,096,576	$1,857,946	$1,857,946	$928,973	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7 Year MACRS	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 Year MACRS	1,843,200		92,160	175,104	157,594	141,926	127,734	114,831	108,749	108,749	108,933	108,749	108,933	108,749	108,933	108,749	108,933	54,374	0	0	0	0
20 Year MACRS	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 Year SL	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 Year SL	3,225,600		107,412	215,148	215,148	215,148	215,148	215,148	215,148	215,148	215,148	215,148	215,148	214,825	214,825	214,825	214,825	107,412	0	0	0	0
20 Year SL	921,600		23,040	46,080	46,080	46,080	46,080	46,080	46,080	46,080	46,080	46,080	46,080	46,080	46,080	46,080	46,080	46,080	46,080	46,080	46,080	46,080
39 Year SL	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bonus Depreciation	24,000,000		24,000,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Major Maintenance 1			0	0	0	0	0	0	0	0	0	173,160	346,840	346,840	346,840	346,840	346,840	346,840	346,840	346,840	346,840	346,840
Major Maintenance 2			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	173,160
Annual Depreciation	**$46,118,400**		**$27,448,212**	**$5,597,292**	**$3,515,397**	**$2,261,100**	**$2,246,907**	**$1,305,032**	**$369,976**	**$369,976**	**$370,161**	**$543,136**	**$717,001**	**$716,494**	**$716,678**	**$716,494**	**$716,678**	**$554,707**	**$392,920**	**$392,920**	**$392,920**	**$566,080**
Asset Book Value:																						
BoP Value			$80,000,000	$52,551,788	$46,954,496	$43,439,099	$41,177,999	$38,931,092	$37,626,061	$37,256,084	$36,886,108	$36,515,948	$41,172,811	$40,455,811	$39,739,317	$39,022,639	$38,306,145	$37,589,467	$37,034,760	$36,641,840	$36,248,920	$35,856,000
Depreciation			(27,448,212)	(5,597,292)	(3,515,397)	(2,261,100)	(2,246,907)	(1,305,032)	(369,976)	(369,976)	(370,161)	(543,136)	(717,001)	(716,494)	(716,678)	(716,494)	(716,678)	(554,707)	(392,920)	(392,920)	(392,920)	(566,080)
Capex			0	0	0	0	0	0	0	0	0	5,200,000	0	0	0	0	0	0	0	0	0	5,200,000
EoP Value		$80,000,000	$52,551,788	$46,954,496	$43,439,099	$41,177,999	$38,931,092	$37,626,061	$37,256,084	$36,886,108	$36,515,948	$41,172,811	$40,455,811	$39,739,317	$39,022,639	$38,306,145	$37,589,467	$37,034,760	$36,641,840	$36,248,920	$35,856,000	$40,489,920