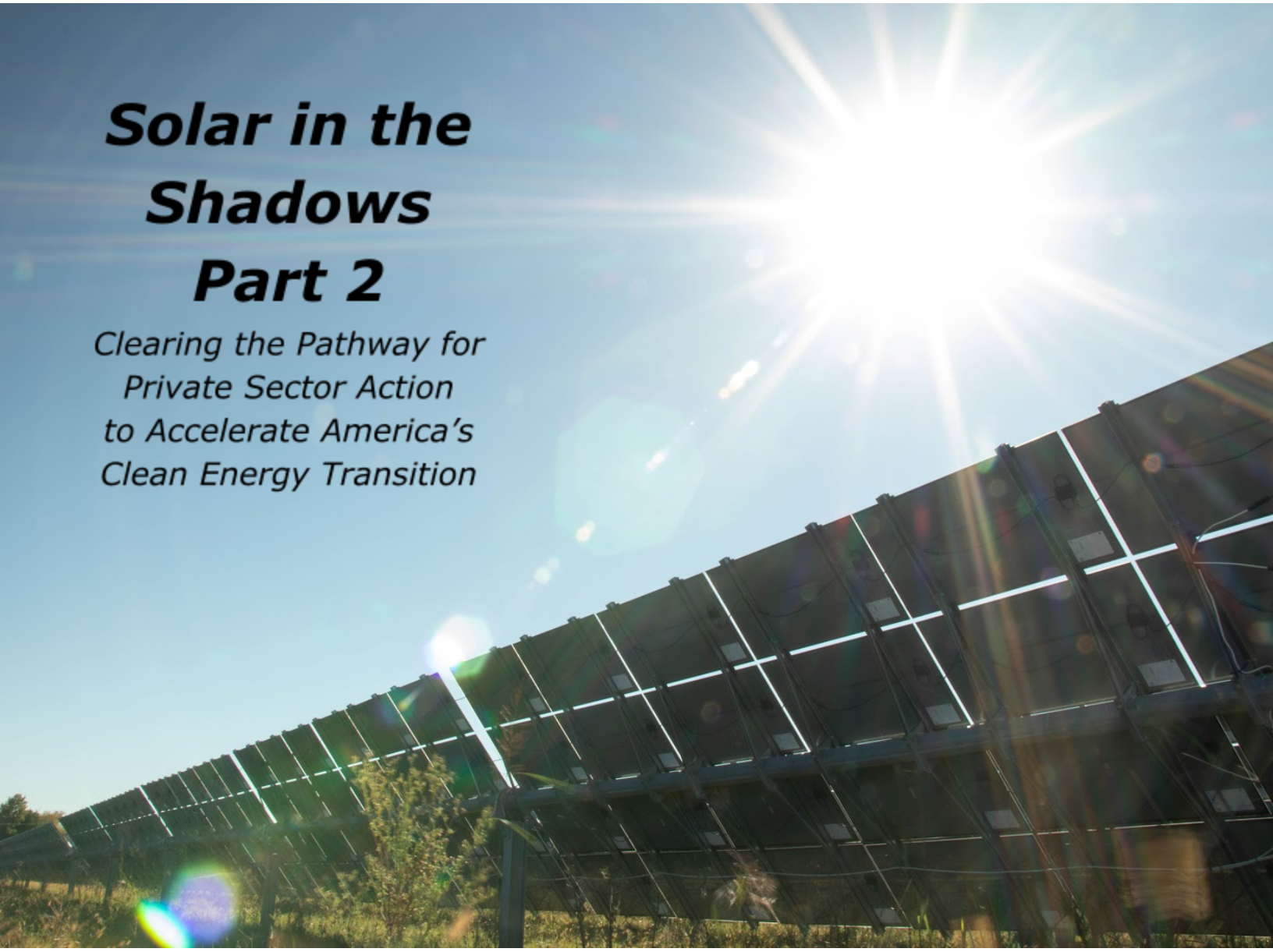

Solar in the Shadows Part 2

Clearing the Pathway for Private Sector Action to Accelerate America's Clean Energy Transition

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"When one looks realistically at where greenhouse gases come from and the relative difficulty and cost of reducing emissions from these various sources, electrical generation completely dominates the picture as the best and most immediate opportunity for scalable reduction. Clearloop directly addresses this opportunity in a creative and unique way and adds meaningful ancillary benefits as well."

Governor Phil Bredesen, Chairman, Clearloop Corporation

Foreword

A growing number of companies are committing tremendous resources to measuring their corporate climate impact and setting ambitious goals to address them, but find many of the mitigation options available to them do not match their values, goals or ambition. For several, the most attractive options are too complex and risky or require long-term commitments they are not able to make. Other options are unsatisfactory due to the age of the credits, concerns about assurance of impact, or lack of connection to their businesses, employees and customers.

Into this context, Clearlosop offers a new option (the Carbon Mortgage) for companies to take meaningful direct action to address their corporate carbon emissions across all scopes. Companies pay a small fee per pound of their current carbon emissions. This fee is used to secure the private financing of the necessary solar capacity required to reduce the equivalent amount of emissions over its lifetime operations. This is a one-time payment for the upfront delivery of the project's lifetime impacts. No long-term obligation, no capital impact and no price risk to our partners, but critically the developer is provided with the upfront financing required to actually finance and build the project. By partnering with Clearloop companies balance their emissions with new solar power capacity in U.S. communities getting left behind in the clean energy transition resulting in tangible climate action by reducing greenhouse gas emissions on the U.S. electric grid where it matters most, while also fostering economic development.

Clearloop is confronting the challenge on how to accelerate the decarbonization of the energy sector by developing a new approach to drive renewable energy development in advance of, and in addition to, policy initiatives. This white paper highlights Clearloop's unique position in the environmental markets, how Clearloop's development model and methodology evolve and improve on traditional carbon programs and underscores the key innovations and best scientific and GHG accounting practices incorporated into the program.

- The Clearloop Team

"The speed at which the energy sector can be decarbonized will critically influence our ability to limit the rise in global temperatures to well under 2 C."
World Business Council on Sustainable Development

The Challenge

There are no silver bullet solutions or any single climate action that will help us achieve a sustainable temperature rise to avoid the worst climate change outcomes. Policy and regulation alone will not sufficiently alter our current trajectory, planting and preserving more trees alone will not alter our trajectory, building more low carbon infrastructure alone will not alter our trajectory nor will individual or corporate action alone alter our trajectory. We need to accelerate all action, public and private, in line with the scale of the threat we face.

Global carbon and renewable energy markets have produced significant reductions in atmospheric greenhouse gases, but like other parts of our economy they have not kept pace with the scale of the threat. In this paper we present a new pathway for private sector climate action; a pathway that sits at the intersection of the voluntary carbon and renewable energy markets. The pathway Clearloop has created is built on sound science, conservative GHG accounting principles, and informed by the needs of businesses of all sizes.

The paper (1) highlights the current state of the U.S. renewable energy market and the options available to companies to procure renewable energy; (2) discusses the challenges with traditional applications of 'additionality' in the carbon market and examines the fundamental principles behind the Clearloop program's ability to drive new development of renewable energy in the U.S.; and (3) demonstrates how Clearloop improves and builds on the learnings and best practices of the current carbon and renewable energy markets to provide a more direct climate action available to more companies.

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1. Today's Market Options: Green Pricing, RECs, VPPAs, and Carbon Offsets

Clearloop's program allows for companies to directly support the expedited deployment of new renewable energy projects reducing greenhouse gas emissions. Key to the approach is the utilization of a new project financing structure that provides developers with the financial certainty required to embark on and finance a new project. This approach will accelerate the transition towards 100% renewable energy.

The electricity sector in the United States has undergone significant disruption over the last decade as demand stabilized, the use of coal declined, and wholesale electricity prices fell. Natural gas and renewable energy, primarily solar and wind, are the favored choices when new power generation resources are added to the US power grids.[1] Changes in policy, technology, fuel prices and consumer preferences have driven these trends. Federal and state policies, technology developments and economies of scale have led to dramatic declines in the cost of solar and wind energy. Consumers, both retail and commercial, have increasingly demanded clean energy but often found a lack of meaningful and easy solutions available. The reduction in natural gas prices, and the corresponding replacement of coal generation resources with natural gas generation, explain the majority of the reduction in greenhouse gas emissions from the US power sector over the last 10 years.[2]

While these are positive trends the expected decline in emissions from the power sector is not happening fast enough compared to the scale of the climate crisis and growing electrification of our economy.[3] Greenhouse gas emissions from the US electricity sector were 1.8 billion metric tons in 2018 which exceeded the combined emissions from every car on the road, airplane in the air, and train on the tracks in the same year.[4] Although the US is deploying an increasing amount of renewable power generation, national emissions are not declining proportionately. Part of the reason for this is subnational concentrations of renewable generation, and associated imbalances in grid emission factors—the addition of new assets in grids with lower emission factors contributes less to national emission reductions than grids with higher emission factors.[5] Fortunately individuals and companies

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[1] US Energy Information Administration: Wind and natural gas-fired generators led U.S. power sector capacity additions in 2019. *https://www.eia.gov/todayinenergy/detail.php?id=43415#:~:text=According%20to%20the%20U.S.%20Energy,new%20generating%20capacity%20in%202019*

[2] US Environmental Protection Agency 2020: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2018 .* *https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2018*

[3] UN Climate Action: *https://www.un.org/en/climatechange/science/key-findings*

[4] Governor Phil Bredesen, July 2020. Why Clean Energy Should Be an American Priority, https://clearloop.us/2020/07/08/why-clean-energy-should-be-an-american-priority/

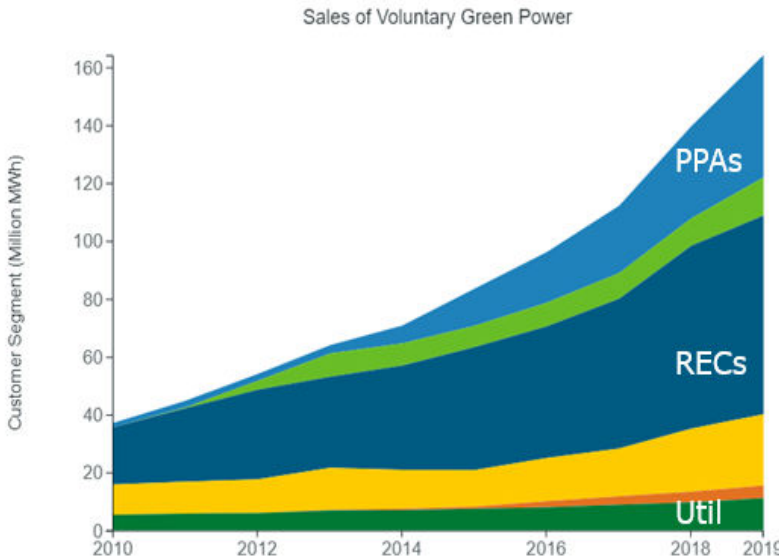
[5] Grids with significant large hydro and/or nuclear generation in lieu of coal powered generation. While nuclear is considered zero emissions it is not a renewable resource. Hydro generation is dominated by large facilities built a long time ago and no longer feasible in the US.

are increasingly vocal about wanting renewable energy and critically showing a willingness to pay for renewable energy. The challenge, now, is how to leverage this support to accelerate the transition of all US electric grids towards carbon neutrality.

Companies that want to reduce their carbon footprints through support or procurement of renewable energy are typically presented with four options: (1) signing up for a green power option, 2) buying Renewable Energy Certificates (RECs), 3) executing a Virtual Power Purchase Agreement (VPPA) and 4) buying carbon offsets from a renewable energy project outside of the US.[6] Each option has advantages and challenges as detailed below.

1) If a company's local electricity supplier offers a ***green power program*** they can sign up for this by agreeing to pay a monthly premium for certified green electricity. The supplier will match the company's electricity demand with RECs from renewable energy projects.[7] Most often the RECs will be from projects already operating in the same regional power grid as the other power plants used to supply customers. This is no guarantee though and the RECs can often be sourced from a renewable project located anywhere in the US. In principle a small share of the monthly premium paid by the customer will end up providing payment to the renewable developer for their renewable energy generation. In any case , these purchases can only be applied to offset emission from electricity usage (Scope 2 or indirect emissions).

2) Alternatively, companies can procure ***RECs*** directly to match their electricity demand. This approach is the most common and accounts for the largest amount of "clean energy" purchased in the market today. This option provides the purchasing entity more transparency and flexibility on the source of its "clean energy" than green power programs. This option is similar to the green power option as the renewable developer will receive revenue from the sale of the RECs and the environmental benefit from the purchase can only be applied to Scope 2 emissions. The problem with both of these approaches is that it is not



[6] Note, companies can also consider installing solar on their premises. While a great option most often companies will not have enough availability of roof space or land to install enough generation to meet their demand. Clearloop is focused on companies in this category.

[7] Companies seeking more transparency on the supply can choose to buy Green-e Energy certified. Green-e is an independent certification program: www.green-e.org

currently possible to finance a project in the US by counting on revenue from REC sales in the voluntary market. The price of the REC, relative to the price of power and other financial inputs is not significant or reliable enough. That being said the REC mechanism serves as a critical tool in determining who can make the usage claim for the renewable energy produced.[8]

3) More recently a third option has emerged primarily for companies with significant power demand and large balance sheets. Companies like Google, Apple and P&G have entered into long-term agreements (15-20 years) to buy power and RECs from a new renewable energy project. In these ***Virtual Power Purchase Agreements*** (VPPAs) the power is settled virtually (financially) while the RECs are delivered directly to the company from the developer. The upfront and long-term commitment by a creditworthy company to buy the power and RECs enables the project developer to finance the project. As such, these projects are a clear and obvious result of the commitment made by the company. The challenges with VPPAs are the financial and risk complexities of executing the deal and the fact that they have to be for large amounts of renewable capacity in order to make sense for all parties (generally 70 MW or more). Differences in market regulation across US power grids have also resulted in some regions being more supportive of these kinds of deals than others. This results in an uneven distribution of new renewable energy development; muting the environmental impact (carbon avoidance) and isolating large parts of the U.S. from the clean energy transition.

4) Finally, companies have the option of buying carbon reductions from renewable energy projects, primarily from projects outside of the US. These ***carbon offsets*** are denominated in metric tons of CO2e reduced and certified by an independent standard - most frequently the Verified Carbon Standard (VCS).[9] Historically, there have been relatively few renewable energy projects generating offsets in the US and VCS has now stopped certifying offsets from new renewable energy projects.[10] Accordingly, for companies interested in driving the transition of the US electricity sector offsets from renewable energy projects are not a readily available option - nor do they have any direct impact on emissions from the US power grid.

Almost all voluntary renewable energy purchases today follow one of the options outlined above. That being said there are several drawbacks to these options primarily centered on

[8] Note this gets to the difference between claiming to buy renewable energy and claiming to reduce greenhouse gas emissions. The critical term in this context is 'Additionality'. The discussion in Section 2 below further explores the concept of additionality in the context of renewable energy in the US.
[9] While there are several carbon offset certification programs, the VCS program is the primary program that has certified offsets from renewable energy projects in the US.
[10] Certain types of renewable energy projects in Least Developed Countries (LDC) countries may still be able to issue offsets. See VCS standard for more information: https://verra.org/project/vcs-program/

complexity (VPPA), volume and long-term purchase commitment (VPPA), and the lack of ability to drive new projects (RECs, Green Power). This last point gets to the concept of **'additionality'** which is a critical concept for evaluating the legitimacy of carbon offset projects.

2. The Importance and Challenges of Additionality

Emission reductions from a new project (or activity) are *additional* if emissions are reduced against the baseline that would have occurred in a business-as-usual scenario. In the case of carbon offset projects the revenue received from selling the offsets is what allows the project to move forward even though it is not a business-as-usual activity.

The term additionality came to the fore with the development of carbon markets, following the ratification of the 1997 Kyoto Protocol. The market mechanisms in the protocol (and since adopted by subsequent emission market policies set up by regions and nations) allow for the use of emission reductions achieved by renewable energy, forestry or other projects to "offset" the emissions from an emitting facility. The rationale for this policy is to drive investments to the cheapest sources of emission reductions wherever they may be. It follows that since the emission reductions can be used *in lieu* of reducing emissions at the source, it is absolutely critical that reductions of greenhouse gases from a project or activity are *in addition to* what is already planned, required and "naturally" occurring with current conditions in the specific market or sector. In short, this is the concept of additionality.

Traditionally there have been two different ways of assessing whether a given project or activity (and the resulting emissions reductions) can be deemed "additional": the *performance* and the *financial* additionality approaches.[11] The first defines a ***performance baseline*** to determine whether a specific activity or technology is "common practice" (or "business-as-usual"). Most often a threshold has been set so if the technology or practice is adopted by less than 2-5% of the market it is judged as being additional.

The primary problems with the performance approach are:

> 1) The threshold that is chosen to define if a project is business-as-usual or not, is commonly set very low to ensure that the test is strict enough to not allow a significant number of non-additional projects to be classified as additional. Therefore, a different approach is needed as technology exceeds the performance threshold but is not yet the preferred option for new implementations.

[11] There are additional tests employed in more of a binary fashion for example if projects are legally required, were initiated prior to the institution of the cabron market, etc. However, while these tests are generally required, they are not sufficient to determine additionality without either the financial or performance approach being utilized as well.

2) A sector dominated by long-term capital projects has less turnover. In this case, even if a large proportion of new installations are employing a low- or zero-emitting technology, the timeline for reducing emissions will extend far into the future. An example of this is the power sector, where operating coal and natural gas plants may stay in operation for 40+ years.[12]

3) Setting sector specific thresholds requires a large volume of data on current and new projects. This necessitates an approach that looks at large aggregations of data across regions while ignoring more localized factors. A practice may be common in one region while very infrequent in another (including regions in the same country). Renewable energy in California vs the US Southeast is one such example.

4) Finally, a specific technology can be adopted to a level exceeding the performance threshold due to compliance mandates while projects financed by voluntary commitments remain rare. Using the performance threshold approach for this type of sector will rule out many additional projects that therefore will never be financed or built. This is especially an issue if compliance mandates (for example Renewable Portfolio Standards) are not targeting 100% adoption of the new zero carbon practice.

Another and more frequently deployed method to determine additionality is the ***financial additionality*** test. The objective is to determine whether financing from the carbon market is the deciding factor that allows a project to reach a return on investment that enables financing to go forward. In short, a project demonstrates financial additionality if it would not be commercially viable without the expected carbon revenue.

While this approach has been used for the majority of carbon offsets in the market today, there are several challenges with the approach:

1) Pricing for offsets in the carbon market has been extremely volatile as policies, technologies and markets have undergone significant transformation. Prices for offsets have ranged from less than $1 to more than $30 per ton. Most carbon project lifetimes average between 10 and 30 years and only move forward if they can pass the additionality test which has to be completed prior to the development of the project. This drives the test to be more hypothetical and based on assumptions rather than on actual capital deployed.

[12] See for example this recent analysis by the Sierra Club documenting the slow transition even among utilities with climate goals: Sierra Club (2020): The Dirty Truth about Climate Pledges. https://www.sierraclub.org/sites/www.sierraclub.org/files/blog/Final%20Greenwashing%20Report%20%281.22.2021%29.pdf

2) In today's carbon market, project financing generally takes place two to five years before the actual sale of any carbon credits so the eventual commitment by the entity seeking to offset their greenhouse gas inventory (the end buyer of carbon offsets) is made long after the decision to move the project forward. Accordingly, most carbon projects are financed by investors and trading entities rather than the ultimate buyers which only enter the market when the offsets have been generated. While this is exactly how most commodity markets work, i.e. the investors take on the largest risk/reward, this represents a unique challenge to relying on the financial additionality test in carbon markets. The value of the commodity (i.e. the offset) is primarily determined by whether the project that generated it can be considered additional, a determination which is based on the price the offsets can be sold for. If there was a large mature and stable carbon market with price transparency, the price would be set exogenous to the project itself. However, without this it is difficult to provide a reliable financial additionality test.

Despite their challenges, the performance and financial additionality tests have been tremendously important in defining project eligibility, accelerating carbon reductions and propelling carbon markets forward. However, as technologies change and climate change action becomes a mainstream priority, there is a growing need for new approaches that target zero emissions and incorporate the local preferences of many voluntary actors. The market solutions available to firms seeking to reduce emissions by adding renewable energy to the grid are either too complex or are not sufficiently "additional''. The tests to assess additionality suffer from an inability to handle markets where long-term emitting processes have to be replaced and where market volatility is significant. These two attributes perfectly capture the nature of the carbon market.

Additionality in the legacy carbon market has taken on greater significance in recent years as there is now increased scrutiny of carbon offsets and carbon financed projects. Skeptics believe that carbon offsets represent a 'permission' for continued polluting. The current backward-looking approach (build first and then sell carbon offset credits) exacerbates the skepticism. Assuring that current carbon emissions (from economic activity) is balanced (reduced) with carbon credits (avoidance, abatement or sequestration) from existing projects is difficult. The causal connection between the entity seeking to balance their carbon emissions and the project that generates the balancing credits is critical. We have reached a point in the climate fight where new pathways are needed to accelerate meaningful action to reduce greenhouse gas emissions if we are to have any chance of slowing, let alone reversing, the damage to our climate.

3. Clearloop - taking the next step in additionality and project financing

Clearloop has developed a transaction structure that directly ties a company's financial commitment to reduce greenhouse gas emissions with the construction of new renewable

energy projects. By doing this Clearloop overcomes three challenges: (i) it guarantees additionality and steps past ambiguity in traditional additionality tests, (ii) it finances projects in grids with high emission factors, to maximize nationwide emission reductions, and (iii) it can be done at any scale, to empower companies of all sizes to take climate action.

In collaboration with the company seeking to balance their emissions footprint with emission reductions, and a renewable energy developer, Clearloop will identify the necessary renewable energy capacity and location that can achieve the desired emission reductions. This approach drives development towards regions where renewable energy development has often been limited even though emissions from the existing power plants are significant.

The key components of the Clearloop approach are:

1) Accelerated Project Development
2) New Carbon Reduction Methodology
3) Ensuring Additionality
4) Protections Against Double-counting
5) Reclaiming GHG Reductions

Accelerated Project Development & Upfront Financing
Clearloop works with the company to scope the size and timing for desired GHG emission reductions. Subsequently, Clearloop and a renewable energy developer identify a project size and location to achieve the desired reduction in greenhouse gas emissions. This approach relies on an accelerated timeline which lends itself to solar photovoltaics being the preferred technology, as it has the shortest project development timeline of any of the renewable energy resources available and it has the greatest generation and emissions reduction potential in most areas of the US.

New Carbon Reduction Methodology
Adding renewable energy to an electricity grid that has fossil fuel powered generating facilities will cause a reduction in greenhouse gas emissions. Whenever selecting a new renewable energy project for financing, Clearloop will use sophisticated modelling to estimate the generation by month and year throughout the project's expected lifetime. This includes factors such as capacity, solar radiation at the specified site, equipment degradation and power market fundamentals. Clearloop and the renewable energy project developer will use these factors to estimate the total greenhouse gas savings achieved, using the marginal emissions on the specific grid. To account for the risk of potential under-performance of the generation due to unforeseen circumstances, as well as for lifecycle emissions for the manufacturing and installation of the solar panels, Clearloop

Why Timing Maters -

Perceptions of carbon offsets have struggled for a number of reasons including difficulty of assurance and complexity of impact measurement. They have also struggled due to the time gap between purchase by end users and project development. The majority of carbon offsets are purchased by brokers and investor intermediaries well before project development and well before purchase by end buyers. This risks breaking the causal connection important to carbon offsetting.

sets aside a significant proportion of the emissions reductions (approximately 40%) in a 'buffer pool'. The buffer pool is created by limiting the emissions reductions delivered to the client to the first 25 years of generation. The solar panels chosen by Clearloop have to provide a 40-year warranty with no more than a 0.5% year over year efficiency degradation. The extra 15 years of production creates the buffer and the degradation is used when calculating the expected emission reductions.

Ensuring Additionality
Working with the developer, Clearloop will identify the revenue required to allow financing of the project. This is the basis for the price provided to the customer for the 25 year stream of emission reductions achieved by the project. If agreement is reached the company buying the carbon offsets will provide the money required for the carbon reduction. The money will be placed in escrow while the project is developed and then released to the project developer when project construction begins. At the end of the process the customer will receive the claims to the emission reduction savings achieved by the project following a methodology that accounts for the longevity of the project but also potential risks.

Timing the payment for the reductions at the same time, as the majority of project costs are incurred, allows for the project to move forward and clearly demonstrates additionality. Hereby Clearloop bypasses the problems of the previous approaches used in the market by having the ultimate buyer commit the money upfront. There is no uncertainty about the demand for and value of emission reductions. The buyer's willingness to pay for reductions upfront is what creates the financial conditions that enabled the project to move forward.

Protections Against Double-counting
Since the reduction of greenhouse gas emissions on a grid when renewable energy is added is a direct result of the renewable energy project developer's activities it has long been established that the claim to these reductions belong to them. That the right to claim a given reduction belongs with the party that caused the reduction has been confirmed by multiple GHG project protocols and carbon markets, including for renewable energy. The only exception is the case where a policy has put limits on emissions from a specific power plant or the electricity sector as a whole. For example if the electricity sector is covered by a cap-and-trade program the emissions are set by the cap as long as compliance is enforced. In this case adding renewable energy to the grid will not necessarily reduce emissions below the cap.[13]

A different but related question is what will happen if Clearloop builds a renewable energy project in a region with no cap and trade program but the region later (during the

[13] Note, some cap-and-trade policies in (California and the Northeast/RGGI) do allow for setting aside and retiring emissions allowances on behalf of sales of renewable energy in the voluntary markets. At the current time Clearloop is not pursuing this option.

project's lifetime) adopts such a program. In this case the emission reductions on the grid have already been created by the project and therefore the baseline from which emissions are to be reduced will be lower. As such, the implementation of a cap-and-trade program will actually further ensure the project's claim to have accelerated the transition towards carbon zero.

Finally, to provide protection against any double claiming the generation will be tracked through the issuance of RECs in a REC registry. These RECs will be retired specifically for the customer with a note explaining that they are retired for the carbon claims made by the customer. This further ensures that no RECs from the project will be in circulation for any other claims or use.

Reclaiming GHG Reductions
Importantly the approach resolves several of the issues in todays' market. *Additionality* is ensured through the commitment of financing in advance of construction of the project ensuring a clear and obvious claim to producing additional emission reductions. *Accessibility* to all types of companies is ensured by allowing for both small and larger projects and by not requiring the buyer to pay and settle the power generated. Simply put, the additionality of the VPPA is combined with the simplicity of a REC or carbon offset transaction.

4. A new path forward

While the current carbon and renewable energy markets have produced significant results, we need more. More innovation, more options and more participants. The markets have established a strong foundation for cooperation, collaboration and impact. However, as with any system, innovation and new models are necessary to keep pace with need and opportunity and to accelerate meaningful action.

Like many of you, we hope for common sense federal carbon policies, but hope is not much of a strategy and history is not on our side here. At several points over the last two decades, the environmental community has pinned its hopes on new federal or state policies to require decarbonization of our economy. This "fingers crossed" approach had many direct impacts on the voluntary markets and cost us all valuable time; time we do not have to address this crisis. Fortunately, the private sector did not wait and instead has stepped up with increasing ambition and commitment. We are still seeing this today with even more ambitious goals; today the benchmark for climate leadership is net zero carbon. Instead of hoping for someone else to solve our problems, we must harness this leadership with solutions that meet the environmental, social and economic values of these organizations. We must act now and be confident that our actions add momentum to policy change.

We must also do more to promote environmental justice and equity here in the United States. Today, far too many Americans live in clean energy deserts; areas with little to no access to clean energy. Here again, many propose we wait for some form of policy change to address this problem. Why should these Americans have to wait? We can expand access to clean energy today with innovation and new models of development. These new developments will be no less impactful and important should common sense federal policy come into effect in the future. There are more than enough willing organizations to dramatically increase clean energy development in those areas getting left behind today. All that is required is focus.

In this white paper, we have highlighted one new model for emissions reduction based on sound science, built on the learnings and best practices of the current market and that seeks to address a number of long standing issues and open the door to more participation from the private sector. With focus and common sense we will open more of the United States to clean energy development, increase green energy access for more Americans and to support the meaningful climate ambitions of more companies of all sizes.

Let's get to work.

Appendix 1 -

Central to the Clearloop financing structure is the upfront purchase of the lifetime emissions reduction credits from the supported new solar capacity addition. This solves a long-standing problem in the legacy carbon market - perceptions of greenwashing due to the time and commitment disconnect with the end buyer of carbon credits. However this ex-ante crediting raises concerns about assurance of impact claims. While these concerns are most relevant for "natural solutions" which are inherently harder to assure, renewable energy projects are not immune to them. Clearloop has answered these concerns in a number of ways as illustrated below.

Demonstration of Ex-Ante Suitability

The Clearloop Grid-Connected Solar Photovoltaic Project Forecast Methodology is suitable for ex ante crediting as it provides for the complete, consistent, transparent, accurate, and conservative quantification and confirmation of forecasted GHG emission reductions from the installation of and electricity generation from solar PV systems, while providing sufficient safeguards to ensure the activities continue for the duration of the crediting period.

The PVWatts® Calculator for calculating solar electricity generation is appropriately conservative and accounts for uncertainty and variation of production over the course of a year. System inputs and losses in PVWatts® are also adjusted based on project-specific information and age to improve the accuracy of the estimated solar electricity generation and grid-electricity emission factors can also be projected into the future by many authoritative sources including the US Energy Information Agency (EIA). Specific safeguards are included to ensure projected emission reductions are realized throughout the crediting period; these include project resilience measures, estimates of solar PV performance decline, and requirements for evidence of continued implementation.

Solar PV panels and their components are also well-suited for a forward-looking approach. The panels are built to last, with highly durable components and few, if any, moving parts, and are often warrantied for 25 or even 40 years. Additionally, even after the end of their warranty period, solar panels continue to produce electricity, albeit with slightly lower efficiency over time. According to a study undertaken by the National Renewable Energy Laboratory (NREL), which looked at the 'photovoltaic degradation' rates of approximately 2,000 solar installations, the average solar panel loses about half of a percentage point (0.5 percent) of efficiency per year, this means that a panel at the end of its 25-year crediting period should still be operating at about 88 percent of its original capacity. However, not every panel will even see degradation rates as high as 0.5 percent. While the solar panels themselves are highly durable, the inverter (which converts the DC from the panels into AC for feeding into the grid) may need replacement sooner. The average inverter warranty ranges from 10 to 15 years. Unlike the PV panels themselves, inverters

tend to simply fail at a point in time, rather than slowly degrade in performance. However, as systems transition from central inverters (which handle the output of all panels) to the use of 'micro-inverters' (which are installed or included with each panel), the durability of this component is expected to match that of the panels.

High initial implementation costs continue to be an important barrier to solar PV installation. However, once installed, solar PV systems have relatively low ongoing maintenance, upkeep, and operation costs. Thus, the incentive from carbon offset credits can help overcome the main barrier to solar PV development.

The issue of abandonment, or failure to operate, of grid-connected solar PV systems is low. Most projects are financed with private capital and backed by operational contracts. Should an Independent Power Producer (IPP) or developer go bankrupt, it is almost assured that the assets, solar PV systems, will be sold to another IPP and continue operations through the full end of life of the system. Ownership of the underlying carbon emissions reductions are clearly conveyed to the Clearloop customer and would survive such an eventuality.

Estimating Abandonment Rates

Given the high upfront implementation costs, significant infrastructural changes, contractual obligations, and financial incentives for continued use of the solar PV systems, project abandonment is not anticipated over the crediting period and is thus not accounted for in this methodology. Confirmation bodies must still confirm evidence of continued implementation is sufficient.

Assurance Pool

As described in the ex-ante section, general operational failure or disruption is assured with warranties, contracts and insurance. Clearloop takes several significant steps to ensure the environmental impact of its projects. In addition to conservative forecasting of electricity generation and conservative estimation of year over year emissions reductions, Clearloop reserves nearly 40% of a project's lifetime carbon reduction potential (15 years of operation) in an assurance pool. Following is a spreadsheet highlighting project estimation for a proposed Clearloop project in the SRTV grid region. If there is a natural disaster that impacts the solar facility for a period of time, Clearloop allocates additional operation of the facility to compensate the loss of emissions reductions beyond the 25-year crediting period.

Initial Crediting Estimate

Year	Annual Output Kwh	Annual Output Mwh	Degradation (.5%)	Annual Average Emissions (lbs/Mwh)	Annual Avoided Emissions (lbs CO2)	Annual Emissions Credits (1 MT = 2205 lbs)	
1	15,813,881.83	15,814	79,069.409	1656.9	26,202,020.80	11,883.00	
2	15,734,812.42	15,735	78,674.062	1656.9	26,071,010.70	11,823.59	
3	15,656,138.36	15,656	78,280.692	1656.9	25,940,655.65	11,764.47	
4	15,577,857.67	15,578	77,889.288	1656.9	25,810,952.37	11,705.65	
5	15,499,968.38	15,500	77,499.842	1656.9	25,681,897.61	11,647.12	
6	15,422,468.54	15,422	77,112.343	1656.9	25,553,488.12	11,588.88	
7	15,345,356.19	15,345	76,726.781	1656.9	25,425,720.68	11,530.94	
8	15,268,629.41	15,269	76,343.147	1656.9	25,298,592.07	11,473.28	
9	15,192,286.27	15,192	75,961.431	1656.9	25,172,099.11	11,415.92	
10	15,116,324.83	15,116	75,581.624	1656.9	25,046,238.62	11,358.84	
11	15,040,743.21	15,041	75,203.716	1656.9	24,921,007.43	11,302.04	
12	14,965,539.49	14,966	74,827.697	1656.9	24,796,402.39	11,245.53	
13	14,890,711.80	14,891	74,453.559	1656.9	24,672,420.38	11,189.31	
14	14,816,258.24	14,816	74,081.291	1656.9	24,549,058.27	11,133.36	
15	14,742,176.95	14,742	73,710.885	1656.9	24,426,312.98	11,077.69	
16	14,668,466.06	14,668	73,342.330	1656.9	24,304,181.42	11,022.30	
17	14,595,123.73	14,595	72,975.619	1656.9	24,182,660.51	10,967.19	
18	14,522,148.11	14,522	72,610.741	1656.9	24,061,747.21	10,912.36	
18	14,449,537.37	14,450	72,247.687	1656.9	23,941,438.47	10,857.80	
19	14,377,289.69	14,377	71,886.448	1656.9	23,821,731.28	10,803.51	
20	14,305,403.24	14,305	71,527.016	1656.9	23,702,622.62	10,749.49	
21	14,233,876.22	14,234	71,169.381	1656.9	23,584,109.51	10,695.74	
22	14,162,706.84	14,163	70,813.534	1656.9	23,466,188.96	10,642.26	
23	14,091,893.31	14,092	70,459.467	1656.9	23,348,858.02	10,589.05	
24	14,021,433.84	14,021	70,107.169	1656.9	23,232,113.73	10,536.11	
25	13,951,326.67	13,951	69,756.633	1656.9	23,115,953.16	10,483.43	290,398.86
26	13,881,570.04	13,882	69,407.850	1656.9	23,000,373.39	10,431.01	
27	13,812,162.19	13,812	69,060.811	1656.9	22,885,371.53	10,378.85	
28	13,743,101.38	13,743	68,715.507	1656.9	22,770,944.67	10,326.96	
29	13,674,385.87	13,674	68,371.929	1656.9	22,657,089.95	10,275.32	
30	13,606,013.94	13,606	68,030.070	1656.9	22,543,804.50	10,223.95	
31	13,537,983.87	13,538	67,689.919	1656.9	22,431,085.47	10,172.83	
32	13,470,293.95	13,470	67,351.470	1656.9	22,318,930.05	10,121.96	
33	13,402,942.48	13,403	67,014.712	1656.9	22,207,335.40	10,071.35	
34	13,335,927.77	13,336	66,679.639	1656.9	22,096,298.72	10,021.00	
35	13,269,248.13	13,269	66,346.241	1656.9	21,985,817.23	9,970.89	
36	13,202,901.89	13,203	66,014.509	1656.9	21,875,888.14	9,921.04	
37	13,136,887.38	13,137	65,684.437	1656.9	21,766,508.70	9,871.43	
38	13,071,202.94	13,071	65,356.015	1656.9	21,657,676.16	9,822.08	
39	13,005,846.93	13,006	65,029.235	1656.9	21,549,387.77	9,772.96	
40	12,940,817.69	12,941	64,704.088	1656.9	21,441,640.84	9,724.10	151,105.74
	587,553,645	587,554				441,504.60	

Green = Crediting Pool **Yellow = Assurance Pool**

The assurance pool also assures credited lifetime emissions reductions against improvements in marginal grid emissions rates over the crediting period. Based on analysis of marginal emissions rates over the last decade, it is clear that the Clearloop assurance pool more than accounts for likely changes in the marginal emissions rates in areas where Clearloop intends to build over the next three decades. The spreadsheet following is an analysis of the marginal emissions rates for the SRTV grid region over the last 12 years. The emissions rate fluctuates up and down based on increased electricity demand and installed generation capacity (all sources). This analysis is similar in all low solar penetration states.

Historic Marginal Emissions Rates (EPA/EIA)

Year	SRMW eGrid	% Change
2006	1742.745147	
2007	1668.587823	4.26%
2008	1788.271849	-7.17%
2009	1870.657936	-4.61%
2010	1767.227579	5.53%
2011	1747.340756	1.13%
2012	1659.927013	5.00%
2013	1681.659775	-1.31%
2014	1738.446502	-3.38%
2015	1730.270409	0.47%
2016	1648.719059	4.71%
2017	1694.293885	-2.76%
2018	1656.977246	2.20%
% Change 2006 - 2018		0.34%
High	1870.657936	
Average	1722.701922	

This is the table of the annual marginal emissions rate for the SRMW eGrid region from 2006 - 2018 (source link tab 1). The SRMW eGrid region's marginal emissions rate improved .34% over the 12 year period. As demonstrated in the preceeding tabs, the Clearloop assurance pool would easily account for this change. The .5% year over year improvement scenario (modeled in tab 3) would represent an 18% improvement over the full operational life of the facility and would still easily be covered by the Clearloop assurance pool.