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CLEARLOOP SOLAR FORECAST METHODOLOGY

CLEARLOOP CARBON STANDARD

clearloop®
A SILICON RANCH COMPANY

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TABLE OF CONTENTS

INTRODUCTION

The Clearloop Solar Forecast Methodology is written to ensure Clearloop projects follow the requirements of the Clearloop Carbon Standard v2 (CCS or Standard) and align to the GHG Protocol for Project Accounting (Project Protocol) and the Guidelines for Grid Connected Energy Projects (GGCEP or GCEP).

The specific steps have been organized to clearly define the project parameters as outlined in Section 1 of the Standard and transparently outline the project fundamentals to ensure each Clearloop project will deliver the impact sought by partners and truly help decarbonize the United States (US) Utility Electric Grid now and in the future.

THE GHG REDUCTION PROJECT

SECTION 1: Project Definitions and GHG Project Activity

Project Definition:
The focus of the Clearloop program is to accelerate new solar photovoltaic (PV) development to decarbonize the US electric grid and expand access to clean energy in parts of the US that are getting left behind in the clean energy transition.

GHG Project Activity:
The GHG reduction project activity is defined as the construction and lifetime operation of new solar PV electric generating plants connected to the United States electric utility grid that generates zero emission (non-firm, load-following) electricity. A grid-connected solar PV system comprises solar panels, a power-conditioning unit, grid connection equipment, and one or many inverters.

Each project must confirm, and document project design, construction timeline, and the following key project parameters required for evaluation and quantification under the Standard.

1. Project Scale: (Watts DC)
2. Geographic Location:
    a. Physical street address or Latitude/Longitude data
    b. eGRID Subregion
        i. Name of Interconnecting Utility
3. Project Start Date (Project commissioning date):
    a. The project fundamentals, design and engineering are complete to ensure the solar system will achieve the forecasted electric power necessary to reduce carbon emissions over the crediting period.
    b. Carbon Credit quantification has been completed and confirmed by management.
    c. Crediting Pool has been created and placed in inventory system to support binding contracts with prospective partners.
4. Expected Construction Commencement Date: (important for credit sales and demonstration of pre-construction payment or contractual commitment and demonstrate additionality).
5. Expected Commercial Operations Date (COD) Date (expected date that GHG reductions shall begin).

6. Expected Lifetime Operation (years):
    a. Each project must provide project warranties, design plans, or other documentation to justify expected lifetime operation.
    b. Unless otherwise noted, Reporting period is equal to the expected lifetime operations (Generally 40 years).
7. Crediting Period (years): (Generally 30-35 years)
8. Baseline Emissions Rate:
    a. MMER data Source:
    b. Year compiled:
9. Project State Solar Penetration Rate (% of total installed solar generation as a percentage of total electricity generation):
    a. Data Source:
    b. Year Represented:

SECTION 2: The GHG Assessment Boundary

Consistent with the Standard and described in the Project Protocol and the GGCEP, each Clearloop project must evaluate all primary and secondary effects of the project activity and determine their relevance to the total emission reductions of the project activity's primary effect.

As defined in the Standard, the primary effect of the project activity is the reduction of GHG emissions from local utility's combustion of fossil fuels. Consistent with the Standard, the primary effect is assessed against a standardized emissions baseline for the eGRID/ISO subregion in which each project is developed. (See below for further detail).

The list of secondary effects below must be quantified using recognized calculation methods or tools from credible sources like the US government, lifecycle analysis experts, or industry tools. It is preferable to use primary emissions data for upstream and downstream secondary effect emissions (i.e., emissions from manufacturing components parts), but not required.

Each project must identify the source of data or tools used to evaluate secondary effects along with justification of their use. If the values are calculated from allocated data, calculation steps must be reported transparently and fully. If a credible tool is used, each project must include the input parameters, results, and documentation.

If relevant data is unavailable or unreliable, justification should consider how other credible standards and methodologies consider these secondary effects.

Table 1: Secondary Effects Project Details

SSR	GHG Source	Gas	Relevant to Baseline (B) or Project (P)	Included/ Excluded	Justification/Explanation
1	Emissions from the manufacture of solar panels	CO_2 CH_4 N_2O	P	*Evaluated on a project-by-project basis*	Example: One-time emission sources equivalent to or less than emissions from the manufacture of construction materials in the baseline.
2	Emissions from the transport of solar panels to the installation site	CO_2 CH_4 N_2O	P	*Evaluated on a project-by-project basis*	Example: One-time emission sources equivalent to or less than emissions from the transport of fossil fuels in the baseline.
3	Emissions from raw materials extraction	CO_2 CH_4 N_2O	B, P	*Evaluated on a project-by-project basis*	Example: One-time emission sources comparable in the project and baseline
4	Emissions from installation/power plant construction	CO_2 CH_4 N_2O	B, P	*Evaluated on a project-by-project basis*	Example: One-time emission sources related to construction/installation
5	Emissions from processing and transport of fossil fuels	CO_2 CH_4 N_2O	B	Excluded	This source does not increase in the project scenario, thus exclusion is conservative
6	Emissions from local utility's combustion of fossil fuels	CO_2	B, P	Included	Reduced CO_2 emissions from displaced electricity generation in fossil fuel-fired power plants due to the project activity are the main source of emissions under this methodology.
		CH_4 N_2O		Excluded	Minor emission sources anticipated to decrease from the baseline scenario.
7	Emissions from leakage	CO_2 CH_4 N_2O	P	Excluded	Example: Negligible source of emissions; it is not anticipated that the project activity will materially cause an increase in GHG emissions outside the project boundary.
8	Emissions from electricity transmission and distribution	CO_2 CH_4 N_2O	B, P	Excluded	Example: Emission sources that may or may not be embedded in a region's emission factors; anticipated to decrease from the baseline scenario.
9	Emissions from system/plant decommissioning	CO_2 CH_4 N_2O	B, P	Note: May be unlikely to be higher than decommissioning of fossil fuel power plants	Example: Downstream emissions related to downstream waste of decommissioning of Solar PV that are greater in the baseline than for the project.
10	Emissions from disposal	CO_2 CH_4 N_2O	B, P	*Evaluated on a project-by-project basis*	Example: Downstream emission sources difficult to quantify and likely greater in the baseline than for the project.

The significance of secondary effects shall be calculated against the total quantified GHG emissions reductions of the primary effect (see Section 12 below for further detail). Secondary effects, individually or in aggregate, at or below 5% of the primary effect estimation are deemed insignificant and excluded from the final GHG reduction quantification.

SECTION 3: Establishing the Baseline Procedure, Baseline Emissions Rate, and Additionality

Grid-connected solar PV electric generating plants predictably provide power during times of peak load and will, therefore, operate similarly to "firm" load-following power plants and, therefore, are classified as load-following. The appropriate baseline candidates are those marginal (load-following) electric generating plants in a grid region. (See Section 4 below)

As outlined in Section 3 of the Standard, Clearloop uses a performance standard procedure reflecting a blended emission rate of identified baseline candidates. Modeled marginal emissions rate (MMER) data is a single standardized baseline candidate.

1. To ensure relevance, documentation must be provided on the source of MMER data, year represented, and the eGRID/ISO subregion represented by the data.
2. To demonstrate conformance to the Standard, all projects will attest that the MMER data is from an approved source, represents the same eGRID/ISO subregion in which the new grid connected solar PV project will be constructed and operated, and that the data is within a 2–3-year temporal range of the expected project commissioning date. (See Section 6 and 8 for BM/OM analysis and stringency test)

As noted in the Standard, MMER data is a suitable baseline emissions rate. Marginal emissions rate data is not simply the average emissions of all marginal generating units in a particular grid region. It is a modeled metric measuring the emissions impact of a grid intervention.

Under many traditional solar PV quantification methodologies, project proponents are required to use the average emissions rate for all marginal electric generating units in a grid area to represent operating margin (OM) emissions and to make a subjective assumption or complete a highly speculative analysis of the build margin (BM) effect of new solar development. Clearloop believes that this is less accurate and often prone to over-crediting solar developments.

Emissions rates (average marginal and MMER) do change year to year, but not significantly and not in a linear fashion (up or down). Changes in these rates reflect changes in both supply and demand. On the supply side, significant changes in electric generating mix occur over decades and is heavily influenced by legal and regulatory contexts that incent or constrain solar PV development above current demand. Clearloop uses a solar penetration threshold and other screening tests to objectively assess the immediate and expected long term emissions reduction impact (BM) for solar PV project development.

Areas of low solar penetration generally confirm implementation barriers to solar development. The Standard and this methodology impose screening tests to ensure Clearloop projects are built in areas where the baseline scenario over the lifetime of the project is a reasonable proxy for the immediate and long term operational and new capacity impacts of solar PV development. *(See Section 7 for additionality tests)*

SECTION 4: Identifying Baseline Candidates

Under a performance procedure required by the Standard, MMER data serves as the single standardized baseline candidate. To confirm that MMER data used to quantify emissions reductions is a blended rate including all baseline candidates, each project implementation report must report and confirm that the MMER data was modeled for the eGRID/ISO subregion or geography in which the project activity will be constructed and operated. This report must also include the year for which the MMER data was modeled and confirm that this is within the 3-year temporal range required by the Standard.

SECTION 5: Justifying the Baseline Scenario

Completion of the baseline procedure screening tests confirms the baseline scenario for eligible grid subregions. Each project report must include test results (with all data sources cited) and attestation of completion of these tests.

SECTION 6: Determining the Extent of Build Margin and Operating Margin Effects

As described in the Standard, MMER data is a blended emissions rate representing all baseline candidates in an eGRID subregion considering BM and OM effects. As required by the standard, default weighting for the estimation formula in the GGCEP Section 11, is 0, making the OM weight 1. The resulting formula is ER = wBM + (1-w)OM or ER =OM.

To demonstrate conservativeness, each project must compare the identified MMER data against other justifiable BM/OM scenarios. For projects below 20MW, it is conceivable that BM weighting could be as high as .3 (30 percent).[1] The source for average emissions data used for this analysis must be from credible public sources and clearly identified along with the year represented by the data. MMER data should be compared to the resulting OM. If MMER data is not more conservative than all reasonable scenarios, justification should be given for the use of MMER.

Example:
Default project output estimation: 2000 MWh per year.
eGRID/ISO subregion: SRTV
Project start date: 2021
MMER: 1136 lbs./MWh (WattTime, 2021)
Average Emissions of all non-baseload generating plants: 1656 lbs./MWh (EPA, 2021)
Average Emissions of all baseload generation plants: 931 lbs./MWh (EPA, 2021)

Scenario	Calculation ER = wBM _ (1-w)OM	ER	
MMER		1136 lbs./Mwh	*Most conservative*
BM w = .1 (10%)	ER = (.1 * 931) + (.9 * 1656)	1583.1 lbs./Mwh	
BM w = .2 (20%)	ER = (.2 * 931) + (.8 * 1656)	1511 lbs./Mwh	
BM w = .3 (30%)	ER = (.3 * 931) + (.7 * 1656)	1438.5 lbs./Mwh	

SECTION 7: Baseline Procedure

As noted in Sections 3 & 4 of the Standard, when using a performance procedure, additionality is presumed if the emissions for the project activity are lower than those of the baseline emissions. However, to truly demonstrate additionality and confirm BM/OM and other assumptions, additional tests are required.

Fundamentally, financial additionality is proved in the Clearloop project design with the upfront payment by our partners. These fees are necessary to the overall project economics and financing necessary to construct and operate new solar PV capacity as defined in the Standard.

[1] GHG Accounting for Grid Connected Renewable Energy Projects, IFI, Section 9

Consistent with a standardized performance procedure, Clearloop requires three screening tests that bear directly on the baseline scenario and other important contexts. Each project must complete and pass the following screening tests:

Legal Requirements Test:

1. Each project must provide attestation that the project activity is not required by laws, statutes, regulations, court orders, environmental mitigation agreements, permitting conditions or other legally binding mandates requiring its implementation, or requiring the implementation of similar measures that would achieve. This attestation should consider federal, regional, state, and local jurisdictions impacting the eGRID/ISO subregion in which the project will be implemented.
2. To the extent realistic and possible, consideration should be given to pending changes to laws and regulation as described above.

Implementation Barriers Test:

As described in section 5 & 6 of the Standard, projects that pass a performance standard test should be those that - in the absence of a carbon offset market - would face more significant implementation barriers than baseline candidates. Projects must complete and pass a barriers test (as described in the GGCEP section 8.2) and justify the parameters assigned to each barrier test.

An important factor in this evaluation is the position of the project proponent relative to the implementation hurdles in each project location. Clearloop and its parent company, Silicon Ranch Corporation, are not utilities which have significant advantages to implementation, especially in traditionally regulated electric markets. In addition, intermittent generating plants like Solar PV do not have the same demand response (dispatchable energy) characteristics that may have higher value to grid operations in areas that do not require emissions reductions in the electric sector. In general, it can be presumed that Clearloop Solar PV projects face much higher implementation hurdles than dispatchable electric generating plants.

Example

Standardized Barriers Analysis Local Jurisdiction:_____ State:_____ Grid Subregion:_____ Date:_____						
	FINANCIAL & BUDGETARY	TECHNOLOGY O&M	INFRASTRUCTURE	MARKET STRUCTURE	INSTITUTIONAL /CULTURAL /SOCIAL/ POLITICAL	RANK BY CUMULAT IVE IMPACT
10 MW Project Activity (Solar PV)	High	Medium	High	High	High	Highest
50 MW Natural Gas CCCT*	Medium	Low	Low	None	Medium	Lower

Projects that pass the barriers test also justify the performance procedure in the estimate of the extent of build margin as outlined in the Standard and GCEP.

Performance Standard Test:

The type and amount of generating capacity present in a particular geographic area when a new project is being evaluated for development provides further objective evidence of project additionality. For the performance test, Clearloop requires a technology specific threshold of total electric generating mix. This is justified because this data is publicly available from the US Department of Energy (DOE) and includes all baseline candidates and requires no additional method to confirm.

Further, the combination of MMER data and these screening procedures is a more objective way to evaluate the full lifecycle carbon reduction impacts of new capacity developments. Emissions rates, particularly marginal emissions rates change based on both electricity supply and demand. Analysis of emissions data over many years shows that average emissions for marginal generating plants (AEMG) do not change significantly year over year nor in a linear fashion. In grid regions with low solar penetration, AEMG rates go up and down year to year based on changes in demand more than supply. In many of these grid areas AEMG rates show an aggregate change of less than 1% over more than a decade.

As solar penetration rates increase in a grid region, AEMG and MMER rate data tends to reduce over time (example California). As noted in the standard, MMER data is not simply a snapshot of emissions at a moment in time (like AEMG data), it is modeled behavior of a grid intervention factoring in the conditions that influence emissions rate changes. For this reasons, Clearloop feels justified in selecting a single baseline candidate for the lifecycle emissions reduction potential of new solar PV developments in the manner prescribed in our Standard.

The Solar PV (technology specific) threshold required by the Standard is 7% based on the full screening regime and current understanding of solar intervention impacts on grid regions. As solar penetration rates achieve levels above 7%, it becomes more likely that new solar PV development will curtail older, less efficient solar PV generating plants (they deliver power at similar time periods) making avoidance calculations difficult and unreliable.

For the demonstration of additionality, the state-level penetration threshold rate for solar PV technology is 7% of total electric generating capacity. Projects developed in states with less than 7% solar PV penetration pass the performance screen. Important to this test is the correlation between electric grid generating mix, emissions rates, and the significance of emissions rate change year to year. Grid emissions do not change significantly year to year in most eGrid/ISO subregions.[2] This is more acute in areas of the country with very little low or zero emissions generating plants.[3,4] Compounding this is the long development time like for Solar PV plants and the long operational life of all electric generating fleets. Projects built above current electricity demand are the most important to reduce grid emissions and accelerating emissions rate change year to year and into the future.[5] States with significant solar PV penetration, show more significant change year to year and would justify the valid time length of the baseline scenario important to Clearloop's development model. The penetration rate will be reviewed annually to ensure the threshold continues to support the valid time length.

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[2] EPA Grid Analysis, Avoided Emissions.

[3] IBID

[4] NREL Study Identifies the Opportunities and Challenges of Achieving the U.S. Transformational Goal of 100% Clean Electricity by 2035

[5] Western Wind and Solar Integration Study, NREL

Each project must report:

1. The source of grid mix data (unless otherwise noted, data from the Energy Information Administration (EIA) Annual Energy Outlook will be used).
2. The date represented by the grid mix data.
3. Percentage of electricity produced by solar PV compared to total electricity produced in the same geographic area.
4. Attestation and documentation that the solar penetration in the project location is below 7%.

Each project must provide attestation that data has been collected from approved sources, follows quality assurance and control procedures and record keeping procedures as outlined in the Clearloop Governance, Policies and QA/QC document which is reviewed and approved annually by the Clearloop Carbon Taskforce and Clearloop Management as described in the document. Where data does not conform to these requirements (all or in part) it must be reported to and evaluated by the Clearloop Carbon Taskforce for an exception to be granted. If data quality issues are identified after project commissioning, the Clearloop Director of Research and Policy must evaluate whether the deviation affects any of the criteria necessary to quantify emissions reductions or the baseline scenario (including valid time length).

SECTION 8: Standardized Baseline Emissions Stringency Test

As described in Section 4 of the Standard, Clearloop uses a performance procedure with relevant MMER data as the standardized baseline for evaluation and confirmation purposes. MMER data is relatively new, but increasingly available in the US for eGRID/ISO subregions.

Where multiple sources of MMER data are available, each project must:

1. Identify these sources.
2. The date represented by the data sources.
3. The rates for the specific eGRID/ISO subregions in which the project is being developed.
4. Perform a comparative analysis of the rates and differences using a simplified calculation for a hypothetical new solar PV development (same expected energy production) in the eGRID/ISO subregion.

Example:

Baseline Candidate	[Source 1] / [Year]	[Source 2] / [Year]	[Source 3] / [Year]
Lifetime Energy Production (MWh)	50,000 MWh over 30 years	50,000 MWh over 30 years	
MMER (lbs. CO2/MWh)	1038 lbs. CO2/MWh	1248 lbs. CO2/MWh	
Total Calculated Emissions Reductions (EP x AMLMER)	51,900,000 lbs. CO2	62,150,000 lbs. CO_2	
EVALUATION	More conservative		

Each project must provide attestation that data has been collected from approved sources, follows quality assurance and control procedures, and record keeping procedures as outlined in the Clearloop Governance, Policies, and QA/QC document, which is reviewed and approved annually by the Clearloop Carbon Taskforce and Clearloop Management as described in the document.

ESTIMATED GHG REDUCTIONS FOR THE GHG PROJECT

SECTION 9: Quantifying Baseline Emissions

As described in Section 4 of the Standard, MMER data is employed as the Baseline Emissions rate and confirmed through a performance standard procedure as outlined in the GGCEP. We believe the approach outlined in this methodology is a very suitable means for quantifying the GHG reductions expected from implementing a grid-connected project activity. The use of such approaches is not discouraged by the GGCEP, and we require additional conservativeness procedures to quantify project-based GHG reductions for the purpose of emissions trading and to demonstrate their additionality.

Each project must complete the performance procedures and screening tests in Section 7 along with necessary stringency tests to confirm the MMER data used as the standardized baseline emissions.

The basic formula to calculate Baseline Emissions is Baseline Emissions = $ER_{Baseline,\ t}$ x $Gen_{Project,\ t}$
$ER_{Baseline}$ = total baseline emissions (AMLMER) for time period t (t CO2/MWh)
$Gen_{Project}$ = electricity generated or avoided by the project activity over time period t. (MWh)
t = crediting period of 30 - 35 years

SECTION 10: Estimating Solar PV Power Generation

This methodology evaluates the electricity production of each project using industry standard tools with project-specific parameters to estimate system electricity generation over the lifetime operation of a project. Each project must report the specific tool/software and input parameters used for estimation. Like other solar PV developments, these estimations are carried out during the early development phase. Clearloop requires specific requirements to remove risk and assure that each project is designed, constructed, and operated to ensure power delivery as modeled. This involves specific siting and due diligence steps, conservative design and engineering plans, and review and confirmation by company experts, third-party engineers, and interconnection partners.

Assumption: The project electricity output delivered to the grid will match or exceed estimations (pre-construction).

Justification: Power output modeling for new solar PV systems is a well-established practice in solar development. It is used for utility planning, financing, and other operational needs. The tools used to develop the output modeling apply the industry standard quantification method and, in our case, incorporate very specific system inputs based on the expected equipment used for development and high-quality operations. Additionally, weather file data is sourced from established entities (like US National Oceanic and Atmospheric Administration or NOAA) and, in our case, incorporate newer technologies like satellite modeling.

Under this methodology, procedures, tools, data sources, data collection, and QA/QC methods are reviewed and approved annually by the Clearloop Carbon Taskforce and Clearloop management. Each project shall include the most recent Clearloop Governance, Policies, and QA/QC documentation used for project commissioning, quantification, design, construction, and operation.

.The result of the design and development procedures is an assured project capacity from which energy output modeling can be performed reliably, consistently, and conservatively.

Each project must provide the parameters and conditions necessary to meet the power output modeling requirements under this methodology. Confirmation report will include:

1. Project Name:
2. Name of Clearloop Director of Policy:
3. Name of Project Developer:
4. Name of Project Development Engineer:
5. Interconnection Pathway (QF, Commercial, Merchant, or other):
6. Site location (address or Latitude/Longitude):
7. Site acreage suitable for solar development and documentation:
8. Evidence of site control (option, lease, or purchase):
9. Site due diligence documentation
    a. Environmental review (wetlands, etc.):
    b. Geotech (sub surface condition report):
10. Name and version of modeling tool:
11. Documentation of System Parameters (components, capacity factors, expected degradation, etc. used for modeling: [i.e., PVSyst 8760]
12. Documentation of Weather file used for modeling: [i.e., PVSyst 8760]
13. Final Project Nameplate Capacity (W_{DC}) and documentation: [i.e., PVSyst 8760]
14. Estimated 1st Year Power Output (MWh) and documentation: [i.e., PVSyst 8760]
15. Confirmation of review by the Clearloop Carbon Taskforce (signed attestation):

SECTION 11: Calculating Estimated GHG Emission Reductions

As described above, Clearloop quantifies the lifetime emissions reductions for each unit of new solar PV system to be constructed and operated to its full expected operating life. To facilitate carbon offset transactions as contemplated in the Standard, new capacity is allocated to T of emissions reductions.

The project implementation report must include all calculations, input factors, documentation and other required information outlined in the standard including:

W – Watts DC [Nameplate Capacity of Project]
ME – Marginal Emissions (lbs. CO_2/ MWh)
CAP and DEG – Capacity factor and warranted system degradation
AC – Annual AC Solar Output per 1 MW of DC Capacity [PVsyst]
LF – Crediting Period of the Project

Performance decline over the lifetime of the grid-connected solar PV system project is accounted for in the capacity factor and established by the warrantied efficiency degradation factor for the solar panels included in the design and engineering of each project. The warrantied efficiency degradation factor must be reported in the parameters below, confirmed by solar panel documentation, and is applied to represent full lifecycle efficiency degradation.

Each project must provide the parameters and conditions necessary to meet the power output modeling requirements under this methodology. Confirmation report will include:

1. MMER data source and year represented:
2. Confirmation of compliance to Clearloop Governance, Policies, and QA/QC document for the relevant year in which the project is commissioned.
3. Full calculation steps and specific project parameters as described in section 10.
4. Confirmation of review by Clearloop COO and CEO (signed attestation):

SECTION 12: Calculating Total GHG Emissions Reductions

As described in Section 9 (28.3) of the Standard, total GHG reductions must account for significant secondary effects by subtracting them from quantified emissions reductions following the formula below.

ER = Total emission reductions from the project (t CO2)
BE = Lifetime baseline emissions of the project summed for the crediting period (t CO2)
SE = Lifetime project emissions of the project summed for the crediting period, equal to zero for solar PV projects (less embodied carbon of the project infrastructure and construction) (t CO2)

Secondary effects (individual or in aggregate) were calculated in Section 2 above. If approved analysis finds significant Secondary Effects (above 5% of total primary effect emissions), they must be subtracted from the total Project emissions reductions. Each project must complete this calculation, document the parameters as described above and attest to conformance to this requirement.

SECTION 13: Credit Pool

The following procedure must be completed after total GHG Emissions Reductions are calculated.

Once total crediting pool is established, credits must be entered into the Clearloop Project Inventory System and be identified with a specific numeric code for management and tracking.

As grid-connected facilities, Clearloop solar PV system projects receive regular generation reports from independent and regulated entities (utility, electric cooperative, or other grid energy off-taker). Clearloop will maintain annual generation reports from independent third parties for all projects. These documents, along with the original project generation forecasts (all years), will be publicly available for inspection and provided to our customers in accordance with our contract.

Each project must provide signed attestation from the Clearloop Director of Policy that data has been collected from approved sources, follows quality assurance and control procedures and record keeping procedures as outlined in the Clearloop Governance, Policies and QA/QC document which is reviewed and approved annually by the Clearloop Carbon Taskforce and Clearloop Management as described in the document.

SECTION 14: Environmental and Social Safeguards

All Clearloop projects will comply with all federal, state, and local land use laws and rules. Clearloop projects will be developed to high environmental standards around land and water conservation (including a prohibition from building on wetlands). Further, Clearloop shall provide customers a community and environmental impact analysis to quantify the environmental, health, economic, and community benefits of Clearloop projects. Clearloop will employ a recognized econometric analysis methodology to express these

benefits. The result is assurance that Clearloop projects are net-positive for the environment, for local communities, and for US sustainable development.

SECTION 15: Regulatory Compliance

Clearloop will comply with all federal, state, and local laws and regulations. Clearloop will provide an attestation letter outlining the regulatory analysis of each project (location specific).

SECTION 16: Ownership and Double Counting

The foundation of any carbon credit program is the credibility and assurance that GHG emissions have truly been sequestered or avoided and that only one entity may own or use these credits to demonstrate GHG emission reductions. As expanded in the ICVCM Core Carbon Principles (Section 4, number 6), no double counting includes: 1) No double issuance (double registration), 2) No double issuance (overlapping claims), 3) No double use, 4) No double claiming with mandatory domestic mitigation schemes, and 5) No double claiming of GHG mitigation arising from other environmental credits.

Double counting is avoided in Clearloop projects through rigorous controls, a transparent process, and legally binding contracts and covenants in the US. Clearloop will attest and execute legally binding contracts that convey all GHG emissions reductions and other environmental attributes of a Clearloop project to the engaged organization in the Emissions Reduction Purchase Agreement (ERPA).

Fundamentally, Clearloop projects are much less prone to double counting concerns because no project is built without an executed ERPA with clear and exclusive ownership conveyed to the purchaser. No commodity credits are created to be sold to third parties. Clearloop will include clear language in any grid interconnection agreements, wholesale energy purchase agreements, or other covenants with interconnecting utilities or energy off-takers, that no GHG emissions reductions or other environmental attributes are sold with the underlying power. Clearloop will file detailed attestations about the exclusive and clear ownership of the GHG reductions and other environmental attributes to the purchaser of the ERPA.

Double claiming is avoided in the Clearloop program through rigorous controls, transparent data, legally binding contracts, and attestation. Clearloop will file detailed attestations about the location, technology, and calculated and verified GHG reductions and exclusive ownership by the purchaser with the appropriate state, regional, and national bodies in the US. The attestations will include copies of the legal contracts and other required elements of the Clearloop program.

SECTION 17: Project Resilience Measures

Project resilience measures are put in place to ensure the lifetime operation of the grid-connected solar PV system and the delivery of the forecasted carbon emissions reductions from the facility's operation. Clearloop projects will include documentation of long-term service plans for continued system monitoring and maintenance and periodic inspections.

SECTION 18: Market Expansion Objective

Clearloop solar PV projects encourage actions leading to GHG reductions that are generally not feasible under existing GHG crediting or incentive programs. Firstly, the carbon offset market in the US has minimal opportunity for carbon credits for renewable energy projects that displace fossil fuel generation of grid electricity. This is particularly apparent by the very uneven distribution of renewable energy facilities in the

US which tend to be built in areas with a legal or regulatory requirement (cap and trade, Renewable Portfolio Standard or RPS, etc.), areas of high resource (sun in the desert, southwest, and wind in the wind belt) and grid regions with higher wholesale energy prices. This leaves much of the US lagging behind in renewable energy development and denying many communities access to clean energy and associated health and economic benefits.

Clearloop has worked with energy industry experts, academic institutions, and others to carefully evaluate industry practices, drivers, barriers to the adoption of solar PV installation in the US. It is clear that parts of the US will not see significant renewable energy development in the near-term, despite decreasing solar PV component prices and market interest in renewable energy development. Clearloop further analyzed the current market options for corporate engagement with new, truly additional renewable energy (Power Purchase Agreements or PPAs and Virtual Power Purchase Agreements or VPPAs) and finds that a significant number of organizations do not have the expertise, financial wherewithal, or desire to sign long-term power purchase agreements. This is especially true of small to mid-sized companies in the US. These organizations like the impact and assurance of renewable energy developments in the US but are denied an opportunity to support them with current market options.

Clearloop's objective is to expand solar development to underserved parts of the US and to expand the market for corporate renewable energy engagement to companies that are not able or interested in long-term power purchase agreements. Our belief is that focusing more private sector support of renewable energy development will accelerate the greening of the US electricity system to achieve levels of decarbonization that experts believe will help avoid the worst impacts of climate change.

SECTION 19: Demonstration of Ex-Ante Suitability

This 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.

Industry standard power output modeling tools approved under this methodology, like The PVWatts® Calculator and PVSyst, are appropriately conservative and account for uncertainty and variation of production over the course of a year. System inputs and losses are also adjusted based on project-specific information to improve the accuracy of the estimated solar electricity generation. 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 with 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. Many studies from authoritative sources, like the National Renewable Energy Laboratory (NREL), found the average solar panel loses about half of a percentage point (0.5 percent) of efficiency per year, meaning that a panel at the end of its 30-year crediting period should still be operating at about 80 percent of its original capacity. 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. Product warranties, binding contracts, interconnection agreements and other documentation on project operations and energy delivery are important evidence to support confirmation of long-term project operations. As noted below, these should be included with each project, including a summary detailing relevance to the defined crediting period, and expected lifetime operation.

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.

PROJECT IMPLEMENTATION AND MONITORING

SECTION 20: Project Implementation

Each project will provide a Project Implementation Report with sufficient detail to serve as the basis for third party verification, validation and confirmation of project implementation and oversight requirements in this methodology have been met. The Project Implementation Report must specify how data for all relevant parameters have been collected and recorded.

At a minimum, the Project Implementation Report shall include the frequency of data acquisition, parameter values, a record keeping plan, and the role of individuals performing each specific monitoring activity. The Project Implementation Report must also include details to confirm and demonstrate that the project passed the legal requirement test and will remain in good operation for the life of the project.

For this methodology, documentation required in the Project Implementation Report includes the following:

- Solar electricity generation calculator, like PVWatts®, inputs the crediting period and supporting project-specific information
- Emission reduction calculations
- Evidence of completed installation and date operational activity commenced.
- Evidence of operational activity (e.g., metered performance)
- Plans for operations and maintenance.
- Warranties and/or contracts for maintenance of solar PV panels and other system components over the crediting period

SECTION 21: Project Monitoring

As noted in Section 17 Clearloop, its parent company, Silicon Ranch, and other affiliates are incented to operate the projects to maximum efficiency and to provide continuous monitoring of project performance to achieve.

Clearloop projects, are monitored by the internal experts in accordance to industry standards and other which provides real-time, monthly, and annual monitoring reports. Additionally, projects include regulated meters to support grid interconnection that provide regular reports of performance. These reports will be maintained by the Silicon Ranch Corporation Performance Team in accordance with company operational and record keeping policies.

In addition, Clearloop creates project microsites for each project that report real-time and aggregate energy production data available to partners and the public. Annual emission reduction reports against the baseline scenario will be created and maintained for the first 10 years as part of the confirmation process described below. Finally, Clearloop microsites provide real time and aggregate emissions reduction data against real time baselines to demonstrate the operation of the grid system and the real-time emissions avoidance of solar generation for each project site.

Project Verification:
Each Clearloop project will follow this methodology to document all reporting requirements included in the Implementation Report. Each project will be verified to the Clearloop Carbon Standard by a qualified third-party. An attestation report will be included in the project record.

Project Reverification:
Within 120 days of project COD, each project must be validated to ensure the project implementation conforms to the parameters and specifications in the Implementation report. An attestation report will be included in the project record.

Project Confirmation and Reporting:
As required by the Standard, each Clearloop project will provide annual reports for partners and available to the public. These reports will confirm project performance against original estimations and the project baseline scenario. Projects that meet or exceed the estimated power output estimations require no additional reporting to confirm program impact as described in the Standard and this methodology.

Each Clearloop project will include the prescribed implementation parameters necessary to calculate emission reductions. Clearloop project plans include robust evidence demonstrating that proposed parameter values are reasonable and conservative. Third-party validators will review all parameter values to ensure their use in the given project is appropriate.

Monitoring, Reporting and Confirmation Period:

As required in the Standard, projects are continuously monitored internally with annual reporting to confirm operational alignment to forecasted power and emissions reductions. In addition to internal reports, documentation should be provided confirming these values including utility generation reports.

For each project, Clearloop will report annual and aggregate electric generation and GHG emission reductions from the project upon commercial operation of the solar PV system. Clearloop will provide annual confirmation reports and maintain records consistent with this methodology to support any additional assurance over the crediting period.

Confirmation activities cannot commence until the project is agreed to and bound by a legal contract and the PV systems have been operational for at least three months. As stipulated above, to be eligible for crediting, the solar PV system must be delivering useful electricity prior to the initiation of confirmation activities for that project. Confirmation must conclude and a Confirmation Statement must be issued no later than one year after the project start date.

QA/QC:

In addition to performing the required quality assurance, quality control, stringency, and other data evaluation steps outlined in the methodology, each project will include a copy of the Clearloop Governance, Policies, and QA/QC confirmation report for the year in which each project is commissioned.

The annual confirmation report includes review and confirmation of approved data sources, modeling tools, validation, verification and reporting review, and other items required for this methodology and to support the Standard.

Record Keeping:

For purposes of independent confirmation and historical documentation, Clearloop will keep all information outlined in this methodology for a period equal to either the project crediting period or seven years after the information is generated, whichever is greater.

Examples of information the project proponent must retain includes:

- All data inputs for the calculation of project emission reductions, including all required sampled data
- Copies of all permits, formal notices of regulatory violations, and any relevant administrative or legal consent orders dating back at least 3 years prior to the implementation of the first project system
- Executed Attestation of Title, Attestation of Regulatory Compliance, and Attestation of Legal Additionality forms
- Results of emission reduction calculations
- Confirmation records and results
- All evidence relating to continued implementation
- Emission factor projections
- Records for proper installation and start date of operational activity

Clearloop also requires that the following project-related records be retained by the confirmation body for a period equal to either the project crediting period or seven years after the completion of confirmation activities, whichever is greater. It must be noted that some records may be subject to fiscal or other legal requirements that are longer than this requirement.

Confirmation bodies shall retain electronic copies, as applicable, of:

- The Project Implementation Report
- Project's source, sink, reservoir (SSR) and/or project activity data as well as evidence cited
- Projects validation and verification reports.
- The Confirmation Plan
- The Confirmation Report
- The List of Findings
- The Confirmation Statement

Each confirmation body must have an easily accessible record-keeping system, preferably electronic, that provides readily available access to project information. Copies of the original activity and source data records shall be maintained within the record-keeping system. Records must be kept in both hard copy and digital format, where possible.

APPENDIX

Clearloop Project Implementation Report

Date:
Compiled by:

Summary of the project and background on the project community

Notes:

Project Parameter	Response/Date/Value	Notes/Documentation/Links
Project Name:		
Project Scale (W_{dc})		
Geographic Location		
Physical address/location:		
State		
eGRID/ISO Subregion		
Site Acreage		
Interconnecting Utility:		
Interconnection Pathway (QF/contractual/other)		
Project Start (commissioning) Date:		
Expected NTP Date:		
Expected Commercial Operation Date:		
Expected Lifetime Operation (Reporting Period)		
Crediting Period:		
Baseline Emissions		
Baseline Year		
Valid Time Length		
Emissions Factor		
Emissions Factor Source		
Emissions Factor year		
Estimated Lifetime Electricity Generation		
Forecasted Emissions Reduction Credits		
Crediting Period		
Ton CO2 (crediting period)		

Clearloop Project Lead		
Project Development Lead		
Development Engineer		

Project Boundary

Define the project boundary for the carbon component of the project and identify the relevant GHG sources, sinks and reservoirs for the project and baseline scenarios (including leakage if applicable).

SSR	GHG Source	Gas	Relevant to Baseline (B) or Project (P)	Included/ Excluded	Justification/Explanation
1	Emissions from the manufacture of solar panels	CO_2 CH_4 N_2O	P		
2	Emissions from the transport of solar panels to the installation site	CO_2 CH_4 N_2O	P		
3	Emissions from raw materials extraction	CO_2 CH_4 N_2O	B,P		
4	Emissions from installation/power plant construction	CO_2 CH_4 N_2O	B, P		
5	Emissions from processing and transport of fossil fuels	CO_2 CH_4 N_2O	B	Excluded	This source does not increase in the project scenario; thus, exclusion is conservative
6	Emissions from local utility's combustion of fossil fuels	CO_2	B, P	Included	Reduced CO_2 emissions from displaced electricity generation in fossil fuel-fired power plants due to the project activity are the main source of emissions under this methodology.
		CH_4 N_2O	B, P	Excluded	Minor emission sources anticipated to decrease from the baseline scenario.
7	Emissions from leakage	CO_2 CH_4 N_2O	P		
8	Emissions from electricity transmission and distribution	CO_2 CH_4 N_2O	B, P		
9	Emissions from system/plant decommissioning	CO_2 CH_4 N_2O	B, P		
10	Emissions from disposal	CO_2 CH_4 N_2O	B, P		

*Primary Effect GHG Emissions:*_____

(for conservativeness and simplicity, this is the Forecasted Emissions Reductions)

*Secondary Effects GHG Emissions:*_____

(provide justification and documentation for calculations.

Notes:

Baseline Scenario

Identify and justify the baseline scenario for the carbon component of the project, in accordance with the procedure set out in the applied methodology and any relevant tools. Where the procedure in the applied methodology involves several steps, describe how each step is applied and clearly document the outcome of each step.

Notes:

Screening Tests

Legal Requirements Test

Notes:

This project is not required by law, regulation or other legal requirement.

Attestation
*Name:*_____ *Title:*_____ *Date:*_____

*Signature:*_____

Implementation Barriers Test

Standardized Barriers Analysis
Local Jurisdiction:_____ State:_____ Grid Subregion:_____ Date:_____

	FINANCIAL & BUDGETARY	TECHNOLOGY O&M	INFRASTRUCTURE	MARKET STRUCTURE	INSTITUTIONAL /CULTURAL /SOCIAL / POLITICAL	RANK BY CUMULAT IVE IMPACT
Project Activity (Solar PV Scale))						
Standard Baseline Candidate (scale) Example: 50 MW Natural Gas CCCT*						

Notes:

This project faces more significant implementation barriers than standardized baseline candidate.

Attestation
*Name:*_____ *Title:*_____ *Date:*_____

*Signature:*_____

Performance Standard Test

Parameter	Description/Data/Documentation
State in which the project is sited	
Source of grid mix data	
Date represented by the data	
Total Electric Generation (GEN_{all}) MWh	
Electric Generation from Solar (GEN_{solar}) MWh	
Solar Penetration = GEN_{solar}/GEN_{all} x 100	
Is state solar penetration below 7% (y/n)	

Notes:

This project is developed in a state with solar generation below the 7% threshold established by the Clearloop Carbon Standard V2.

Attestation
*Name:*_____ *Title:*_____ *Date:* _____

*Signature:*_____

Financeability Test

Notes:

This project, without the carbon credit fees, does not meet the financeability hurdle (IRR threshold) as established in the Clearloop Carbon Standard V2. (please attach analysis spreadsheet and supporting documentation).

Attestation
*Name:*_____ *Title:*_____ *Date:* _____

*Signature:*_____

Estimating Solar PV Power Generation (Lifetime)

Project Parameter	Response/Date/Value	Notes/Documentation/Links
Solar PV Simulation Software		
Were Standard Development Parameters Used (y/n)		
Was Conservative Weather Model Used (y/n)		

Detail table for system output estimation and carbon credit calculations here:

STEP	Description	Process Owner	Yes/No/Explanation of deviation	Key Documents	Notes

Calculating Estimated GHG Emissions Reductions

Consistent with the Clearloop Carbon Standard V2, Clearloop carbon credits are based on the amount of new solar PV capacity (measured in watts) necessary to avoid 1 T of carbon emissions from the electric grid over its lifetime operation. To support this approach, Clearloop applies a new and different emissions factor from the average emissions generally associated with grid connected energy projects. We also apply conservative metrics and discounting to ensure the impact modeled for each watt of new solar PV capacity. For assurance purposes, every year we review the requirements and criteria necessary to support the accuracy and soundness of the carbon standard and quantification methodology and the credits associated with each Clearloop project.

Standardized Baseline Stringency Test

MMER data is now available for every ISO Subregion. Where there are multiple sources of data, a stringency test must be performed to evaluate the selection of a data source. Justification for the selection of the specific source of MMER data must address the stringency analysis. If selected data source is lower than the average mean value of all data sources, no justification is required.

Data Source	*Year Represented*	*Value (lbs./MWh)*	*Deviation to Mean*
Source 1			
Source 2			
Source 3			

Mean value (Source 1 + Source 2 +Source 3)/Number of Sources	

BAESLINE SCENARIO TESTING:

1 YEAR BASELINE SCENARIO AT VARIOUS ER REDUCTION RATES
AVERAGE EMISSIONS DATA FOR BASELOAD AND NON-BASELOAD GENERATING PLANTS

Average Emissions D Source _____
eGRID/ISO Subregions:_____
Year Represented:_____

Baseload	
Non-Baseload	

MMER	

As outlined in the GHGP and GCEP, project emissions rates must consider the carbon impact of new grid connected energy projects on operating margin (OM) and (BM) and apply a weighting factor represented the blended emissions rate of all baseline candidates in the geographic boundary of each project. In the US, the appropriate geographic boundary is the eGRID/ISO or balancing authority level. To compare the MMER data against average emissions rates, this test looks at weighting levels described in the GCEP. For small scale projects (under 20 MW), realistic weighting levels in the US would be 0 to 20 percent. This test includes scenarios up to 50% BM weighting for additional assurance.

Scenario	WEIGHT	W*Baseload	PLUA	(1-W)*Non-Baseload	EQUALS	ER	MMER MORE CONSERVATIVE
AVG0	0%		+		=		
AVG1	10%		+		=		
AVG2	20%		+		=		
AVG3	30%		+		=		
AVG4	40%		+		=		
AVG5	50%		+		=		

In 2021, EPA forecasts that the US electric grid will decarbonize between 24 and 38 percent in the next 30 years from the 2005 grid baseline. For conservativeness and simplicity, this test applies the same projection to the eGRID/ISO subregion level and sets the baseline year as 2021. To model this forecasted decline, this test looks at year over year percentage declines at 1, 2, and 3 percent year over year emissions reductions resulting in scenarios representing 25, 44, and 59 percent emissions reductions over a 30 period.

Clearloop Credit pool =

	25% ER Decline	44% ER Decline	59% ER Decline
AVG0			
AVG1			
AVG2			
AVG3			
AVG4			
AVG5			

Attach all calculation spreadsheets and other documentation to this report. Green = MMER data and Clearloop baseline scenario are justified (emissions reductions are lower than or equal to scenario emissions reduction values)

Demonstration of Additionality

Question	*Response*	*Discussion/Evidence*	*Reviewer*
Is the Project required by law or regulation?		*(Note attestation above)*	
Was the generation of carbon credits considered prior to the start date of the mitigation activity?		*(Clearloop Project Commissioning and Environmental Attributes Sale Agreement, Clearloop Marketing Material, etc.)*	
Were the following tests completed?			
Investment Analysis		*(See Financeability test above)*	
Barriers Analysis		*(See Barriers test above)*	
Market Penetration Analysis		*(See solar penetration test above)*	

Environmental and Social Safeguards

Notes:

This project complies with all federal, state, and local land use laws and rules. Clearloop projects will be developed to high environmental standards around land and water conservation (including a prohibition from building on wetlands).

Attestation
*Name:*_____ *Title:*_____ *Date:* _____

Methodology Deviations
If there were any deviations from the Clearloop Solar Forecast Methodology, please provide a description and justification in the box below. Include evidence to demonstrate the following:

- The deviation will not negatively impact the conservativeness of the quantification of GHG emission reductions or avoidance.
- The deviation relates only to the criteria and procedures for monitoring or measurement and does not relate to any other part of the methodology.

Notes:

Attestation
*Name:*_____ *Title:*_____ *Date:* _____

Monitoring Plan
Describe the process and schedule for obtaining, recording, compiling, and analyzing the monitored data and parameters set out in Section (Data and Parameters Monitored) above. Include in the description the process and schedule for obtaining, recording, compiling, and analyzing the monitored data set above.

Notes:

Attestation of compliance to the Clearloop Governance Policy and QAQC practices as outlined in the Clearloop Carbon Standard

Attestation
*Name:*_____ *Title:*_____ *Date:*_____

Final Approval:

_____ Date:_____
Clearloop Director of Policy

_____ Date:_____
Clearloop COO

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