CLEAN COALITION
Making Clean Local Energy Accessible Now

Local CLEAN Program Guide

Module 2: Establishing CLEAN Contracts Prices

June 2012

About the Clean Coalition

The Clean Coalition is a nonprofit organization whose mission is to accelerate the transition to cost-effective clean energy across the United States. The Clean Coalition believes that the right policies will result in a timely transition to clean energy while yielding tremendous economic benefits.

Contact Us

If you have any questions about the Guide or if you are interested in becoming a local champion for a CLEAN Program in your community, please email LocalGuide@Clean-Coalition.org.

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Making Clean Local Energy Accessible Now

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Overview of the Guide

CLEAN Programs create local jobs and investment opportunities.

The Purpose of the Guide

This Local CLEAN Program Guide is designed to help communities and their local utilities evaluate, design, and enact **Clean Local Energy Accessible Now (CLEAN) Programs** based on global best practices and the expertise developed by the Clean Coalition through our work on designing and advocating for CLEAN Programs throughout the United States.

The Structure of the Guide

The Local CLEAN Program Guide is comprised of seven modules.

Module 1: Overview & Key Considerations provides an overview of CLEAN Programs and guides readers through the process of evaluating how a local CLEAN Program will match community goals, resources, and constraints.

Module 2: Establishing CLEAN Contracts Prices provides a roadmap for establishing optimal fixed prices for CLEAN Contracts.

Module 3: Evaluating Avoided Costs provides approaches for determining avoided costs to the utility and/or community.

Module 4: Determining Program Size & Cost Impact explains how to assess the amount of renewable electricity to purchase through a CLEAN Program and determine the associated cost impact, if any.

Module 5: Estimating CLEAN Economic Benefits provides approaches for estimating the local economic value of energy purchased through CLEAN Contracts.

Module 6: Designing CLEAN Policies & Procedures explains how to design streamlined program policies and procedures.

Module 7: Gaining Support for a CLEAN Program describes how to obtain community support and gain official approval for the program.

1) Overview of the Process

The optimal fixed price will attract the desired amount of renewable energy capacity within the target timeframe and at the lowest cost to ratepayers.

This module of the Local CLEAN Program Guide provides a roadmap for establishing optimal fixed prices for CLEAN Contracts. The optimal fixed price for each eligible type of renewable energy project is the price that will attract the desired amount of new renewable energy capacity within the target timeframe and at the lowest cost to ratepayers.

Setting optimal prices is critical to the success of a CLEAN Program. Prices set too high will ensure rapid development of local renewable generation, but will result in less clean energy produced for a given budget and cause an unnecessarily higher impact on electricity rates. Prices set too low will not attract enough renewable energy development to accomplish community goals because potential project developers will not have the financial incentive to invest. Setting CLEAN Contracts prices high enough to trigger a strong market response will drive down renewable energy prices more quickly. As more system installers participate in the local market, increased experience, competition and economies of scale will lead to lower CLEAN Contracts prices after the program's initial targets have been reached. As the program matures, lower CLEAN Contracts prices will lead to lower electric bills for community members.

When setting CLEAN Contracts prices, the community must determine the following:

- Which types of projects does it want to purchase renewable electricity from?
- How much renewable electricity does it aim to buy from these eligible project types?
- How much will it cost a developer to produce energy from an eligible project type?
- What is the value to the community of energy produced by an eligible project type?

This module shows how the answer to each of the questions above will influence and be influenced by the answer to one or more of the other questions. CLEAN Contracts prices are established by several stages of estimates relating to these questions. At each stage, additional information and decisions made by the community will inform and refine the next set of estimates.

Table A: Example Steps for Establishing CLEAN Contracts Prices

1) Produce an initial estimate of the optimal prices

2) Share estimates with stakeholders and solicit input

3) Establish the program size and eligible project types

4) Obtain more accurate and detailed cost and value data

5) Create refined estimates of optimal initial prices

6) Share refined estimates with stakeholders and solicit input

7) Propose prices and obtain approval for the first set of contracts

8) Review the local market response and the current local costs of generation, local value of energy, and community goals

9) Adjust prices for future contracts or the desired program size, if appropriate

In the example above, the utility staff member, private consultant, or stakeholder consultant leading the development and implementation of the CLEAN Program starts the process by making an initial estimate of prices. This process involves proposing eligible project types, making initial estimates of the desired program size, selecting the contract term, and selecting and applying the pricing method based on this information. Next, the program designer will share these estimates with key stakeholders, solicit feedback, and obtain more accurate and detailed data. Then, policymakers will establish the program size and eligible project types. At this point, the program designer will refine the estimates of prices, relying on the additional data and new decisions. After sharing the refined estimates with stakeholders and soliciting their input, the program designer will propose prices for the first set of CLEAN Contracts and obtain approval for these prices. As the program matures, the community will adjust prices for future contracts based on the local market response, changes to the local cost of generation or the local value of energy, and new community goals.

This module explains how to choose eligible project types, determine the local cost for a developer to produce energy from an eligible project type, and determine the local value of energy produced by an eligible project type.

CLEAN program procedures should include processes for modifying prices based on market response, as measured by the rate at which program capacity is being subscribed at the existing price. Generally, programs include a mechanism for adjusting the price, sometimes as simple as authorizing policymakers to adjust the price for new projects each year. Large programs, however, are well suited to mechanisms that automatically adjust the price for new projects based on a Volumetric Price Adjustment (VPA) mechanism. A VPA mechanism allows pricing for new projects to adjust both up and down depending on the speed at which program capacity is subscribed at the existing price. VPA mechanisms are highly transparent; the associated capacity volumes, time periods, and price adjustments are predefined.

2) Propose Eligible Project Types

The first step for estimating prices is to consider which types of projects will be eligible to participate in the program.

The program designer will evaluate potentially eligible project types based on a review of the following:

- **Overall goals of the community**, as described in Module 1.
- **Local value of generation** for each potentially eligible project type, meaning the value to the community of the renewable electricity produced by the potentially eligible project type, as described in Section 4 below.
- **Local cost of generation** for each potentially eligible project type, which is estimated by determining the local generation potential and the local system costs, as described in Section 4 below.

Each **eligible project type** consists of a designated combination of renewable technology, project size parameters, project configuration, and project site.

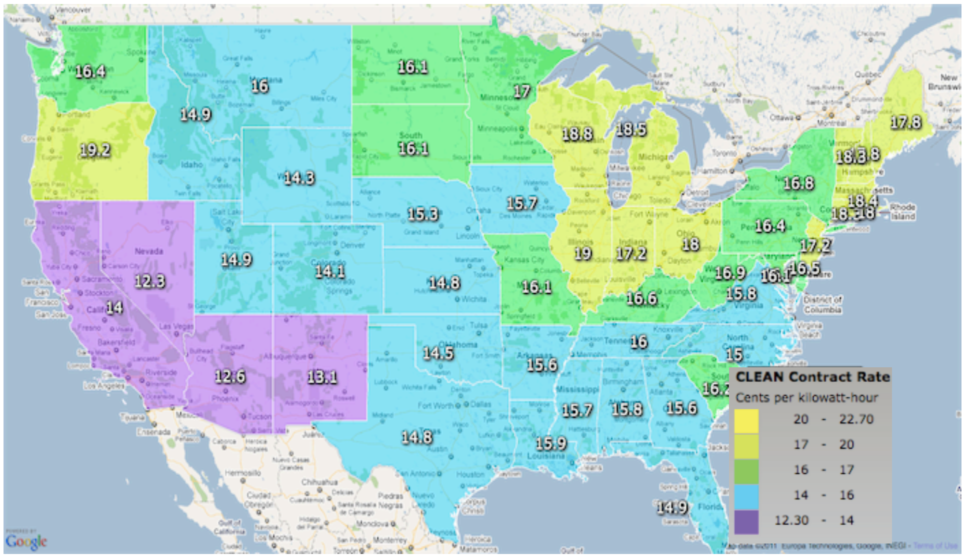
When determining which potential eligible project types warrant further consideration, the program designer should make an initial estimate of the local cost of generation for each type. The initial estimate may be based on readily available state, regional or U.S. market data. Later estimates should be based on detailed cost estimates and cost breakdowns shared by developers, suppliers, installers, and customers to account for cost components that vary by location.

Renewable Technology

CLEAN Programs can be adopted for any type of renewable energy technology and may include energy from solar photovoltaic (PV) panels or biogas from dairy farms, landfills and sewage facilities, as well as energy produced from wind, geothermal, and small-scale hydro projects. A greater diversity of technologies priced and offered by the program will give a greater number of community members the opportunity to participate in the market. However, for each additional technology to be included in a program, the program designer must gather another set of local market data and perform a separate pricing analysis. To balance these concerns, many communities choose to initially start a program with only one eligible technology with the expectation that more technologies will be included as the program proves itself.

- **Solar Photovoltaic (PV)** systems are often included in local CLEAN Programs. While every community in the U.S. has a different combination of renewable resources, studies have shown that almost every state could get 20% or more of its electricity from solar PV alone.[i] Further, solar pricing is increasingly competitive with traditional sources of electric energy as module and installation costs have significantly declined in recent years. From 1998-2009, solar PV installed costs in the U.S. dropped by about 40%.[ii] Solar PV installed costs fell by more than 25% from 2008 to 2009 alone.[iii] As U.S. markets achieve the scale of leading markets like Germany, small commercial rooftop systems will require even lower CLEAN Contracts prices, as shown below.

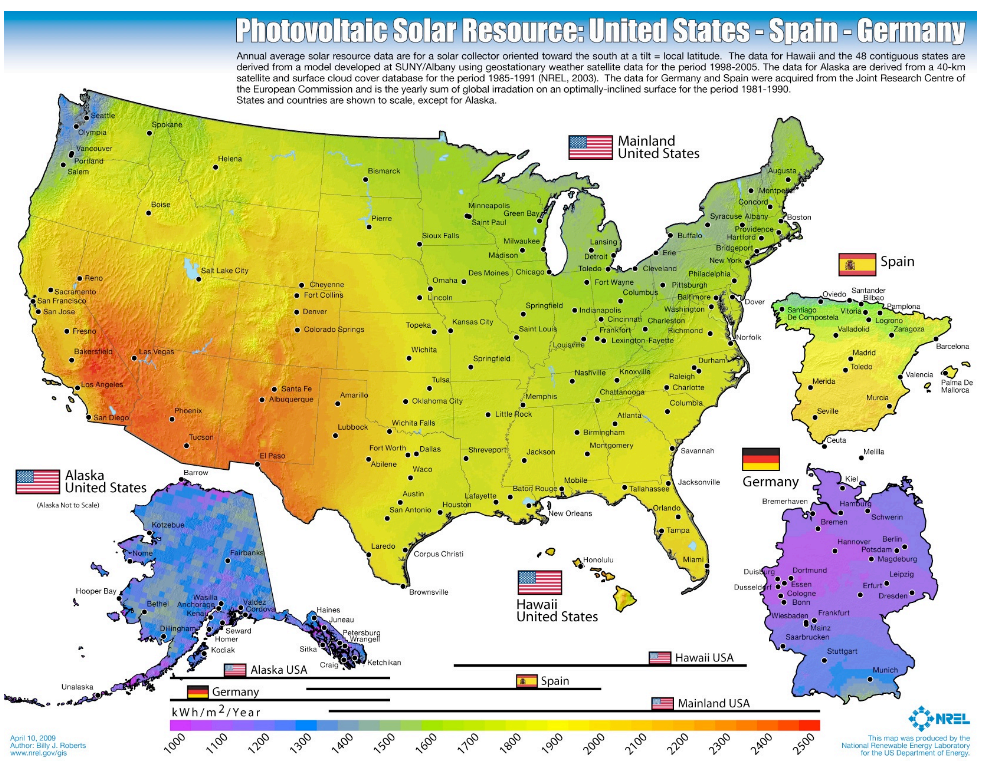
Figure 1: CLEAN Rates Required for Solar PV Rooftop Projects up to 30kW[iv]



Source: John Farrell, Pricing CLEAN Contracts - feed-in tariffs- for Solar PV in the U.S., June 2011.

Assumptions: $3.50 per watt installed cost and efficient use of the investment tax credit and 5-year accelerated depreciation. Prices on the map also reflect better solar resource quality relative to Germany, as illustrated in Figure 2 below.

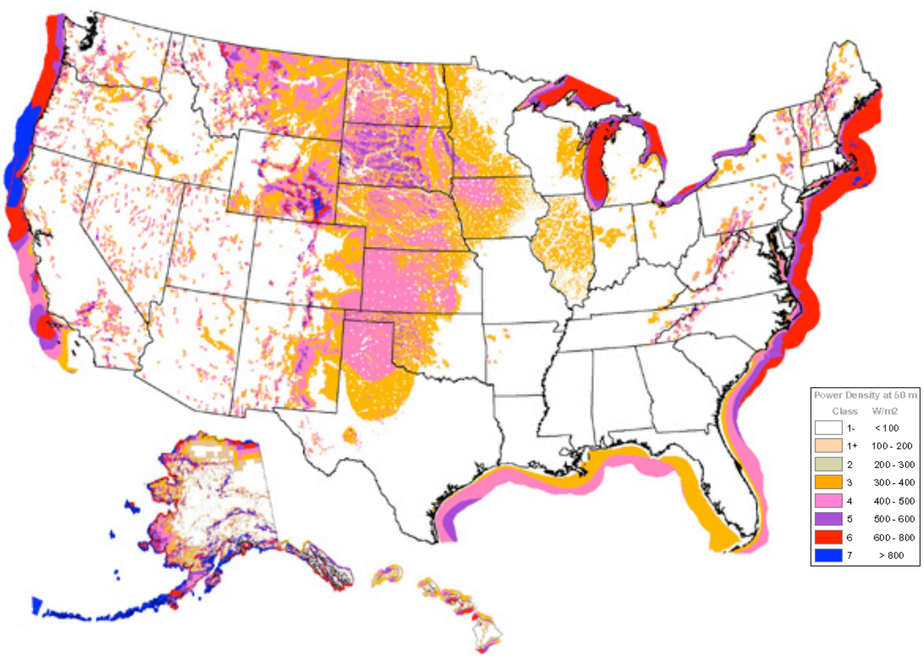
Figure 2: Better Solar PV Resource Across the U.S. Compared to Germany[v]



Source: U.S. Department of Energy National Renewable Energy Laboratory

- **Wind Power** is cost competitive with new natural gas projects in many regions[vi] and is approaching the cost of new coal projects in some regions.[vii] The U.S. Department of Energy has found that smaller wind projects (between 5 to 20 megawatts (MW)) benefit from construction and project economies of scale, yet avoid higher financing costs attributed to larger projects. The higher costs of projects over 20 MW stem from the time and monetary investments required to build a new transmission infrastructure and the legal costs associated with securing land rights.[viii] In Germany, a country that has had a CLEAN Program in place since 2000, more than half of its 27,000 MW of wind energy are projects that are 20 MW or smaller.[ix] As a result, local residents own roughly half of the country's wind turbines.[x] Many states have great wind energy potential, as shown below.

Figure 3: United States - Wind Resource Map[xi]



Source: U.S. Department of Energy National Renewable Energy Laboratory

- **Biopower** is a cost-effective option for many regions, depending on feedstock availability. Common options for biopower include biogas from waste-streams found at sewage treatment facilities, dairy farms, and landfills, as well as biomass from grape pomace and a variety of other dry agricultural waste-streams.
- Other potential technologies include **small-scale hydropower** and **geothermal energy**. The resource potential of these technologies varies widely by region. Options for small-scale hydropower include run-of-river, tidal, and wave technologies.

Project Size Parameters

Each eligible project type will include project size parameters. A CLEAN Program may include projects of up to 20 MW of capacity, which is generally the largest project size that can interconnect to the distribution grid without extensive infrastructure improvements. The project sizes included in the program can have a significant impact on program prices and participation. Larger installations may take advantage of economies of scale and may provide generation at a lower cost to ratepayers, while a greater number of smaller projects may result in broader participation in the program. A CLEAN Program can support a variety of project sizes through graduated pricing, as demonstrated in the Appendix.

Project Configuration

The physical attributes of a utility district will help determine the appropriate project configurations for eligible project types. Urban areas are generally well suited for rooftop installations on warehouses, commercial buildings, and residences, as well as parking lots, capped landfills, and other underutilized spaces. Rural areas will likely have more land available to support ground-based renewable energy facilities.

Project Siting

CLEAN Programs generally limit project sites to locations within the local utility's distribution grid. The program designer may recommend further limiting the program to projects located within designated zones on the local distribution grid. A project's location on the distribution grid can affect the cost of generation for the project. Projects in certain locations may be able to take advantage of the local distribution grid's existing capacity or to interconnect to the grid after minimal, inexpensive upgrades. Projects in other locations may require expensive upgrades or extensions of the grid. The program designer should work with utility engineers to determine optimal grid site zones and how much electric production can be interconnected to the distribution grid within these zones. In order to ensure that all eligible project types will be connected to the grid quickly and inexpensively, the program designer may recommend defining eligible project types to only include projects located within pre-designated zones on the distribution grid that can support new generation without expensive or time-intensive upgrades.

3) Estimate the Program Size and Contract Term

Program Size

The program size is the target amount of new local renewable energy capacity to be purchased within a designated timeframe. The program size will influence the selection of eligible project types; larger programs can support a greater variety of eligible project types.

The local market response to CLEAN Contracts prices will determine whether the program achieves the target amount of new local renewable energy capacity within the desired timeframe, while staying within the program's budget and ratepayer impact constraints. A community may decide to implement a pilot program to test the local market response to CLEAN Contracts prices before initiating a full-scale program. A well-designed pilot program aims to achieve a modest amount of new renewable capacity over a brief time period (e.g. two years) and simplifies the pricing process by limiting the number of eligible project types.

Module 4 of this Guide explains how to select the program size, program budget and maximum ratepayer impact. For the purpose of initially estimating CLEAN Contracts prices, the program designer may create an initial rough estimate of the program size or work with several program size options.

Contract Term

CLEAN Contracts guarantee fixed prices for a long duration. For the purpose of producing initial price estimates, the program designer can estimate a contract term of 20 years.

Setting a longer contract term can reduce the CLEAN Contracts price necessary to incentivize new solar and wind projects. These types of projects require a high initial capital investment and relatively low operation and maintenance costs. Further, a longer contract period allows developers to secure financing with a longer loan repayment period and accordingly lower fixed payments.

Developers of certain types of projects, such as biogas and biomass systems, may prefer a shorter contract term, such as 10 or 15 years. These projects require a smaller initial capital investment and higher operation and maintenance costs. Further, developers of these projects may have trouble predicting multi-decade access to affordable feedstocks.

4) Select and Apply the Pricing Method

Once eligible project types and program sizes have been proposed, the program designer can choose which pricing method to apply to initially estimate the CLEAN Contracts price for each eligible project type and program size.

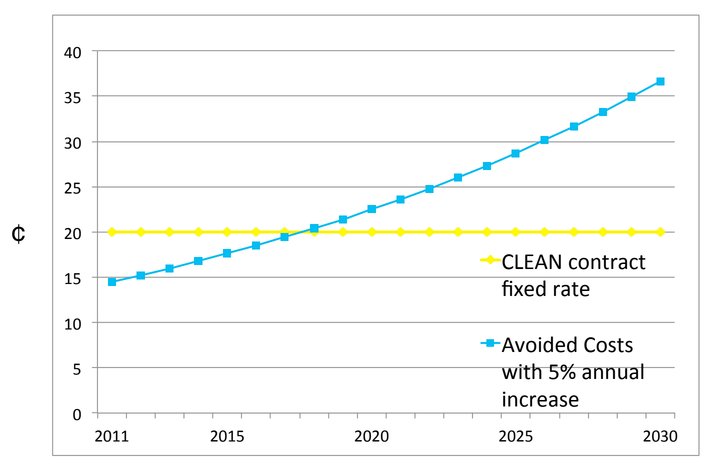
Table B: CLEAN Contracts Pricing Methods

- The **cost-based pricing method** is applied by estimating the local cost of generation for each eligible project type and adding a target rate of return for the developer. This method is the most effective approach for attracting a specific quantity of new generation within a desired timeframe, since it relies on a calculation of the price required to attract the desired level of market response. However, this approach may require higher initial price offerings than the value-based approach.
- The **value-based pricing method** is applied by estimating the local value of generation for each eligible project type. This is the value to the community of the renewable electricity produced by the eligible project type, which includes the "avoided cost" to the utility and ratepayers, and may include the avoided "external cost" and the economic benefits to the community. The fundamental value-based method has a neutral rate impact, but it may fail to produce the desired scale of project deployment within the planned timeframe, or fail to achieve the local market development, economies of scale, and project price reductions expected under a cost-based program.

As the local cost of generation decreases and the avoided cost increases, the difference between the results of these two approaches becomes less significant. As the market price and supply trends under either approach are established, simple price adjustments can be made to maintain the desired pace of project capacity to be added.

Figure 4: Convergence of Cost-Based Pricing and Avoided Costs Over Time

For this single 10 kW solar rooftop project in Colorado, avoided costs will rise above the CLEAN Contracts price within a few years.



Source: The Clean Coalition

Cost-Based Pricing Method

The program designer may apply the cost-based pricing method to calculate CLEAN Contracts prices by estimating the local cost of generation for each eligible project type and adding a target rate of return for the developer over the contract term.

For each proposed eligible project type, the program designer will take the following steps:

1. First, the program designer will estimate the **local cost of generation** for the eligible project type by determining the local generation potential and the local system cost.

    a. **Local system cost** represents the total costs to the system developer of initial development/installation costs and annual operating costs, after consideration of taxes, incentives and investment tax credits, over contract term. The relevant costs are listed in **Table C** below. The program designer may gather this market data by surveying system installation companies that are interested in participating in the program. Local system cost data can also be found online. For example, utilities and PV installers across the country voluntarily report on metrics such as solar cost-per-watt, system size, and location as part of NREL's Open PV Project.[xii] The **Appendix** shows how local system costs were estimated for a CLEAN Program designed for Fort Collins, Colorado.

Table C: System Costs and Assumptions

- **Initial development/installation costs** include:
    - Equipment costs (modules and inverter), plus any state or municipal sales tax that applies at the time of purchase
    - Balance of system (BOS) costs (racking, wiring, concrete etc.)
    - Permitting costs
    - Engineering, development, and professional services costs
    - Labor costs
    - Grid interconnection costs

- **Annual operating assumptions** include:
    - Simplified cash/owner financing cost (assuming debt financing would impact results based on loan rate)*
    - Inflation (generally assumed to be 2%)
    - Discount rate (this is used for discounting future cash flows, and the discount rate is generally around 5%)
    - Insurance costs of the system (insurance is generally half a percentage point of total system cost)
    - Taxes vary by location and may include federal, state and local obligations:
        - Income taxes, measured by the electric production of the system
        - Commercial or personal property taxes, measured as a percentage of the value of the system
    - Operation and maintenance (O&M) costs (based on system capacity and type)
    - Inverter replacement costs

*Financing considerations can be eliminated by assuming that projects are financed through 100% owner equity, a financing scenario known as an "unlevered" that solves for a target internal rate or return (IRR) using a 100% equity financing assumption. Unlevered target IRRs generally range from 5% to 8%. Debt and/or tax equity financing could impact results depending on whether outside financing can be secured at rates lower than, equal to, or higher than the target unlevered IRR.

b. **Local generation potential** is the local quality and quantity of the relevant renewable resources. A community can begin its evaluation of local renewable resources with free online tools. For example, the U.S. Department of Energy (DOE) has calculators and other tools for determining the availability of renewable resources on its Energy Efficiency & Renewable Energy (EERE) website.[xiii] Communities can also solicit the help of local stakeholders, such as universities, businesses, environmental groups, and other research organizations to determine their local generation potential. For example, the University of California Los Angeles (UCLA) Luskin Center School of Public Affairs and the Los Angeles Business Council (LABC) led the research effort to determine Los Angeles' local generation potential for the city's proposed CLEAN Program. They found that Los Angeles County has 19,113 MW of physical rooftop solar potential.[xiv]

2. Next, the program designer will model the eligible project types to establish the predicted energy output of each. This information will be used to determine the income that the project would receive at any price offered per kilowatt hour (kWh).

3. The program designer will propose the desired internal rate of return on investment (typically around 8% unlevered) for the developer over the contract term. CLEAN Programs spur investment in projects with a lower rate of return than would otherwise attract investors by reducing project development risks, development schedule timelines, and legal and administrative costs. This leads to more local renewable energy and lower costs for ratepayers.

4. Once the local cost of generation and predicted energy output have been estimated, the program designer can use a financial model to determine the price per kWh necessary for each eligible project type to provide the developer with the desired return on investment. Public and proprietary software is available for system output and financial modeling, as described below; however, the results depend upon both the accuracy of data entered and decisions regarding program values.

5. The program designer will run a sensitivity analysis with modeling software on the following key variables to determine their impact on pricing and profitability:

    a. **Internal Rate of Return (IRR) sensitivity:** The IRR will impact the CLEAN Contracts pricing or the number of viable projects at any given pricing. For example, the sensitivity analysis conducted for the CLEAN Program in Fort Collins, Colorado showed the degree to which changes in IRR impacted the price per kWh. (See **Appendix**.)

    b. **Installed cost sensitivity:** The installed cost of an eligible project type impacts the price of energy or the number of viable projects at a given price. For example, the sensitivity analysis conducted for the Fort Collins CLEAN Program showed that a cost increase of $0.55 per watt above mean installed cost value of $2.75 per watt resulted in a 40% reduction in economically viable project opportunities, which could be offset by a $0.02 to $0.03 per kWh higher tariff rate. Costs per watt were projected to consistently decline in subsequent years.

c. **Inflation:** Since most renewable energy technologies (like solar, wind, hydro, and geothermal) have no resource or feedstock cost, there is generally no need to include an inflation escalator into CLEAN pricing. If necessary to reduce initial CLEAN pricing levels, however, an escalator can be used. This added complexity simply shifts project income to later years.

d. **Cost of Capital:** Projects that are not privately financed will rely on capital markets for financing, which will affect the cost of generation. Lenders in established CLEAN Program markets recognize that CLEAN projects are secure, low risk investments.

e. **Tax burden:** State and local taxes may apply to equipment purchases and/or the installed costs of projects. At the same time, there might be state and/or local tax rebates or exemptions for equipment manufactured within the jurisdiction.

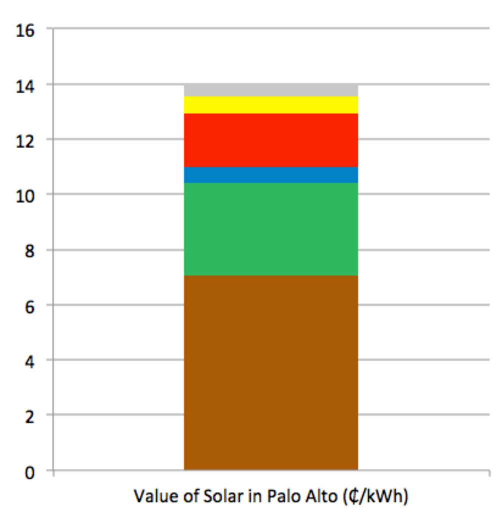
Value-Based Pricing Method

The program designer can apply the value-based pricing method to calculate CLEAN Contracts prices by estimating the local value of generation for each proposed eligible project type. The **local value of generation** is the value to the community of the renewable energy produced by the proposed eligible project type. This value includes the “avoided cost” to the utility and ratepayers, and may include the avoided “external cost” and the economic benefits to the community.

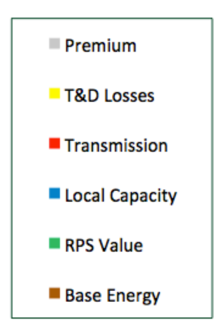
For each proposed eligible project type, the program designer will take the following steps:

1. First, the program designer will quantify the **avoided cost** of the proposed eligible project type, meaning the market value or replacement cost of energy with comparable attributes. The relevant comparable attributes include transmission costs and other locational benefits, Renewable Energy Certificates (RECs), time of delivery, predictability, back-up generation required, and resources used. Module 3 explains how to quantify these costs.

Figure 5: Value of Solar PV in Palo Alto (¢/kWh)



“Palo Alto CLEAN will expand clean local energy production while only increasing the average utility bill by a penny per month” -- Yiaway Yeh, Mayor of Palo Alto



Source: City of Palo Alto Utilities and the Clean Coalition[xv]

2. The program designer may also quantify the **avoided "external cost"** of the proposed eligible project type to the community, in accordance with Module 3. Policymakers will determine if any avoided external costs will be included in this analysis, such as greenhouse gas emissions, air pollution, energy security and other costs.

3. Finally, the program designer may quantify the **economic benefits** of the proposed eligible project type to the community, in accordance with Module 5. Policymakers will determine which economic benefits will be included in this analysis, such increased job creation, private investment and tax revenues.

CLEAN pricing that is limited to the direct avoided cost to the utility and ratepayers will have a neutral rate impact, but it may fail to produce the target market response within the desired timeframe. This would occur if the pricing does not cover the cost of generation plus a reasonable rate of return for project developers. A program designer can estimate the likely market response to a proposed value-based price by comparing it to an estimated cost-based price.

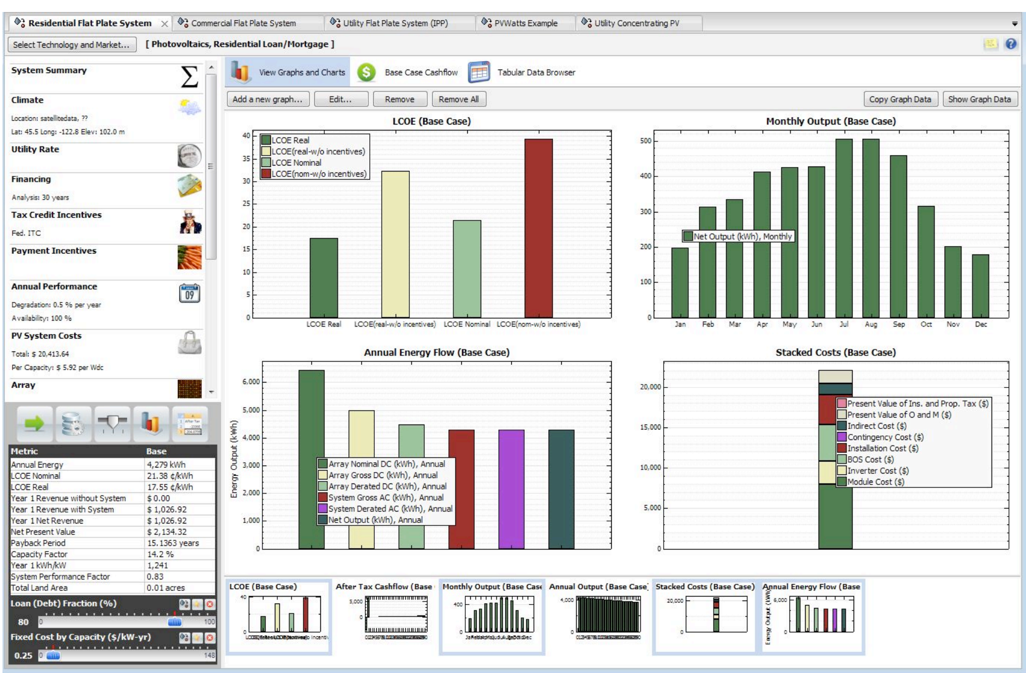
CLEAN Contracts prices may include the value of local economic benefits, such as increased job creation, private investment and tax revenues.

Modeling Tools

Program designers may perform all necessary pricing analyses with the publicly available modeling tools described below. Additional proprietary tools are also widely available. The Clean Coalition makes no express or implied endorsement of any modeling tool.

- **National Renewable Energy Laboratory's System Advisor Model (SAM)** is a free, publicly available tool designed to facilitate decision making for renewable energy program designers and other renewable energy industry participants. The model calculates the cost of generating solar, small wind, and geothermal electricity based on information provided by the user about a project's location, installation and operating costs, type of financing, applicable tax credits and incentives, and system specifications.[xvi]
- **RETScreen Clean Energy Project Analysis Software (RETScreen)** is a free, publicly available tool often used for wind projects. The software evaluates the energy production and savings, costs, emission reductions, financial viability and risk for various types of renewable energy.[xvii]
- **The Cost of Renewable Energy Spreadsheet Tool (CREST)** is a free, publicly available tool that is the product of a partnership between the National Renewable Energy Laboratory (NREL), the U.S. Department of Energy (DOE) Solar Energy Technologies Program (SETP), and the National Association of Regulatory Utility Commissions (NARUC). CREST is an economic cash flow model designed to enable policymakers, utilities and renewable energy industry members to assess renewable energy project costs, design cost-based incentives, and evaluate the impact of tax incentives or other support structures. CREST is a suite of three analytic tools, for solar (photovoltaic and solar thermal), wind, and geothermal technologies.[xviii]

Figure 6: National Renewable Energy Laboratory's System Advisor Model Screenshot[xix]



Source: U.S. Department of Energy National Renewable Energy Laboratory

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[xii] Data *available at* http://openpv.nrel.gov/index.

[xiii] Tools *available at* http://apps1.eere.energy.gov/buildings/tools_directory/.

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[xv] Data provided to the Clean Coalition on March 28, 2012 by Jon Abendschein, Resource Planner, City of Palo Alto Utilities; Quote from Clean Coalition press release, "Palo Alto Leading the Charge on CLEAN Programs," March 6, 2012, *available at* http://www.clean-coalition.org/press-releases-and-advisories/2012/3/6/palo-alto-leading-the-charge-on-clean-programs.html.

[xvi] *Available at* https://www.nrel.gov/analysis/sam/.

[xvii] *Available at* http://www.retscreen.net/ang/home.php.

[xviii] *Available at* http://financere.nrel.gov/finance/content/CREST-model.

[xix] *Available at* https://www.nrel.gov/analysis/sam/.

Appendix – Fort Collins CLEAN Contracts Pricing

Table A: Required 20-Year Fixed CLEAN Contracts Rates for Solar PV by Category

System size (example only)	Installed cost $/W(dc)	Initial output kWh(ac)/kW(dc)-yr	20 year fixed PPA price
3 MW ground	**$2.75/W**	2,090	**13.69** ¢/kWh
1 MW ground	$3.00/W	2,090	14.74¢/kWh
1 MW roof	$2.50/W	1,615	16.35 ¢/kWh
500 kW roof	**$2.75/W**	1,615	**17.72**¢/kWh
100 kW roof	$3.00/W	1,615	19.08¢/kWh
50 kW roof	$3.25/W	1,615	20.45¢/kWh

Modeling Assumptions:

- Installed cost is turnkey cost per nameplate capacity (dc) for completed interconnected solar PV system delivering power to the grid, including all permits, fees, taxes, administrative costs, overhead and margin for projects 100% financed by project owners. Installed costs will vary with market maturity (size and competition).
- Modeling performed with NREL Solar Advisor Modeling and PVWatts system design.
- Analysis includes no escalator and no residual value after 20-year term of PPA.
- RECs are bundled with energy sales.
- Internal Rate of Return (IRR): 8%, unlevered (i.e. 100% financed by project owners).
- Nominal discount rate: 7%.
- Federal depreciation: MACRS 5-year (without bonus option).
- Federal tax rate: 28%.
- Federal Investment Tax Credit (ITC): 30%.
- Site rental: $10,000/MW/yr.
- O&M: $18/kW/yr for fixed tilt rooftop, $28/kW/yr for single axis tracking ground mount.
- Inverter replacement reserve: $10/kW/yr.
- Interconnection costs: 20¢/W(dc) including gen-tie and network upgrades (i.e. $200,000 for a 1 MW system).

Location Specific Assumptions:

- System output based on NREL's TMY3, direct normal solar irradiance: 2060 kWh/m^2
  - Rooftop installation (fixed tilt angle: 35º), ground mounted (single axis tracking).
- State tax rate: 4.63%
- State tax benefits: MACRS schedule.
- Sales tax: 6.75%
- Property tax: 0.51%
- Property tax depreciation: 5% average annual decrease in assessed value.

Potential Adjustments influencing PPA price (based on 500 kW rooftop at 20.54¢/kWh):

- PPA term 25 years: -1.1¢/kWh.
- Add PPA escalator @ 1%: -1.2¢/kWh starting price reduction.
- IRR target +/- 1%: 1.1¢/kWh.
- Installed cost +/- 25¢/W: 1.4¢/kWh.
- Site rental costs +/- 50%: 0.4¢/kWh.
- O&M cost +/- $5/kW-yr: 0.4¢/kWh.
- Grid interconnection +/- 50%: 0.5¢/kWh.
- Debt & tax equity financing rates can affect results if they differ from the IRR.