CLEAN COALITION
Making Clean Local Energy Accessible Now

California Energy Commission

Re: Docket No. 12-IEP-1D

Clean Coalition Comments

May 30th 2012 CEC Workshop

Jobs and Renewable Energy in California

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June 6, 2012

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Making Clean Local Energy Accessible Now

The Clean Coalition appreciates the Energy Commission's commitment to a well-informed renewable energy policy in California and the opportunity to submit these comments. This comprehensive series of workshops is an important effort to gather and unify the complex, often overlapping challenges of transforming the way we generate and use power.

The Clean Coalition has produced a concise guide on estimating economic benefits, which is attached as an appendix. While this was developed primarily in support of publically owned municipal utilities as part of the Local Clean Program Guide[1], the issues, methodologies, and referenced sources are broadly applicable to state policy development as well.

There are many reasons to rapidly develop a renewable energy economy, and perhaps the most concrete and broadly appealing reason is the local economic growth and job creation that accompany this decision. Following the workshop, we wish to emphasize several particularly salient factors, some of which were not addressed in the presentations:

- Renewable energy development in California **directs ratepayer dollars directly into the State economy**, recirculating energy expenditures into domestic wages and economic activity.
- Renewable energy development **retains and attracts new large capital investment to the State**, both from private funders and through Federal grants, tax credits, and accelerated depreciation options.

  By example, at an average installed cost of $2.50/W, the 12,000 MW Clean Energy Jobs Plan alone would result in $30 Billion invested in California. This is not a zero sum game taking investment away from alternative opportunities in the State; these funds are in addition to attractive opportunities in other sectors, and these funds will otherwise flow to competing national and international investment outside of California.

- California industries became **leading suppliers of clean energy** technologies due substantially to demand driven by state policy. As the State pursues leading RPS levels, innovation and intellectual property developed here to meet these targets will continue to attract investment and **drive product solutions that can be exported globally**.

[1] http://www.clean-coalition.org/local_clean_program_guide/

- Job impact analysis must consider not only **direct employment** in construction and operation of energy facilities, but **indirect employment** in the supporting industries, **induced employment** as these households spend new income, and the impact on State revenues from **increased sales and income taxes** combined with savings **from reductions in costs associated with unemployment**.
- Renewable energy facilities **generate new long-term revenue and (taxable) income streams** from primary or secondary uses of property, including disturbed lands and existing buildings.
- Renewable energy development **adds to State revenues, and does not require State expenditures**.
- Renewable energy **reduces externalized cost burdens associated with conventional generation** that impact employment through higher public and private mitigation costs ranging from broadly applied air quality compliance to health care expenditures.

Every year, Americans spend about $2300 per person on energy purchases. Of this amount, approximately 40% goes to pay for electricity. Energy purchases represent a significant cost to society nationally and locally and it is important to spend energy dollars in a way that strengthens the economy rather than depleting it.

In many cases, energy dollars leave the community, going to regional utilities or suppliers of oil or natural gas. Once those dollars have been spent on importing energy into the community or state, they are not available to support economic activity in that area. States such as New York, Missouri, Wisconsin and Maine all report over $1,000 per resident per year leaving the state for energy imports. With thirty seven million residents, California likewise is heavily dependent upon imports for non-renewable generation.

Because every dollar spent on imports is a dollar lost from the local economy, these energy imports represent a substantial loss to local companies in terms of income and jobs. California is blessed with a variety of good quality accessible renewable energy resources distributed throughout the state, including at or near local loads. The goal and the challenge is to meet our appetite for energy while supporting local economic development.

As noted in the May 30th workshop, the details of economic impacts, how many jobs, where, and

of what kind, can be debated extensively. However, while California is still in the early stages of this energy transition, we are not proceeding without precedent. The following studies and examples point to how well the broad link has been established between increased renewable energy and long-term employment, and the clear opportunities available to California.

Huge investment potentials not currently being achieved

Simply meeting California's RPS goal will not ensure we have achieved the most benefit for our investment. How and where we generate that energy will have a huge impact on the size and resilience of California's economy.

An analysis by Max Wei and Daniel Kammen of UC Berkely finds that a Feed-In Tariff (FIT) targeting wholesale distributed generation (WDG) will create significant economic benefits to California over the next decade when compared to a "business-as-usual" approach to acquiring the same quantity of renewable energy through existing programs. [2]

The following estimated benefits would be seen in this decade (2011-2020):

- A 200-300% increase in job creation over existing RPS procurement practices, yielding a net additional 28,000 direct jobs and 27,000 indirect and induced jobs on average throughout this period, after accounting for displaced employment in conventional generation.
- Job creation weighted toward the earlier part of the decade, resulting in more rapid employment benefits due to more rapid deployment achieved through a High DG scenario.
- Attraction of up to $50 billion in total new investment in the state.
- Up to $15 billion in Federal tax benefits for California project developers.
- $1.7 billion in state revenues from sales tax, use tax, and income taxes on direct employment. Additional induced revenues of $600 million realized from increased employee compensation and the impact of program costs. Additional savings not calculated would be seen in avoided unemployment benefits, and additional tax revenues from investment returns in this sector.

[2] REESA Feed-In Tariff: Analysis of Economic Benefits, Max Wei and Daniel Kammen, Renewable and Appropriate Energy Laboratory, University of California, Berkeley (http://rael.berkeley.edu), In cooperation with Clean Coalition http://www.clean-coalition.org/storage/resources/studies/economic-benefits-of-a-fit/economic_benefits_of_a_comprehensive_feed-in_tariff-july072010.pdf

- Importantly, energy costs from renewables are consistently seen to decline as procurement increases, while conventional generation costs trend upward. Modest early negative electric rate impacts are more than offset first by positive net employment impacts, and then further by longer term rate reductions and price stability compared to conventional sources. Conventional energy spot market energy cost are also seen to be suppressed due to reduced demand resulting from increased use of renewables.

Two charts, included below, show the current gap in incentives and the market value we stand to gain if that regulatory gap is filled with real support for WDG.

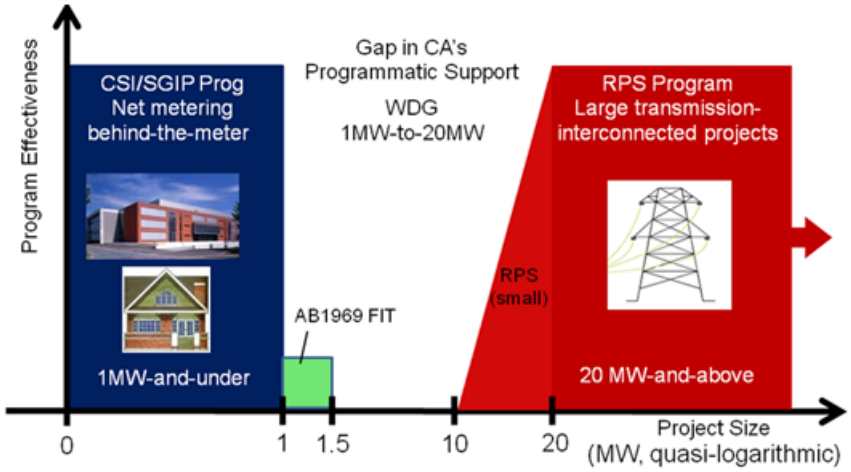

Figure 1. Schematic of current CA state programs showing the gap in support in the intermediate range of 1-20 MW(WDG)

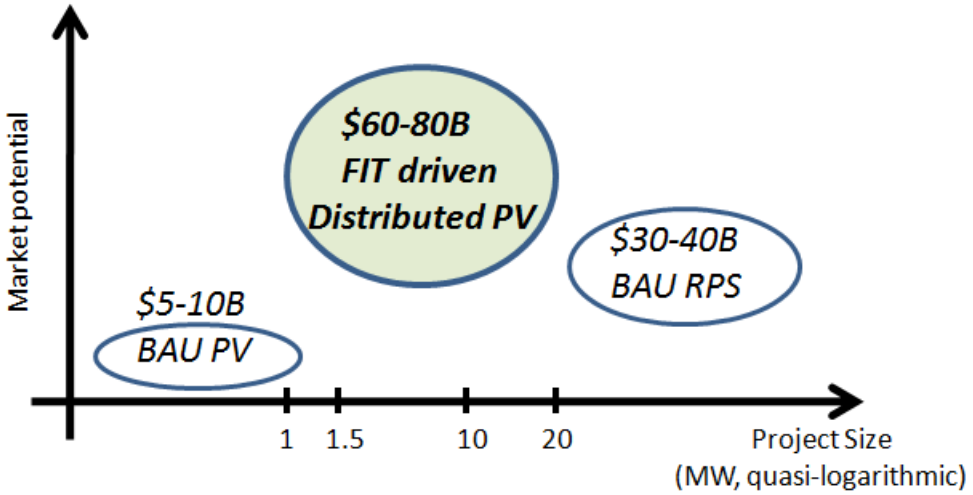

Figure 2. Market size comparison. Small (<1MW) and large (>20MW) estimates are based on business as usual (BAU) CARB projections while WDG (between 1 and 20MW) estimate is based on projections in the Kammen report.

Increased jobs seen around the world

Germany is an oft-cited example of how to do renewable energy right. There are numerous studies and reports on their success, which do not need repeating here, but a few numbers published by the German government emphasize the impact on employment they have already seen. [3,4]

- 382,000 jobs as of 2011 from the development and production of renewable energy technologies and the supply of electricity, heat and fuel from renewable sources
- This is a 4% increase over 2010 and more than double the 2004 figure when new energy policies were implemented.
  (from "Renewable Energy Sources in Figures, National and International Development")

The Province of Ontario has also recently embarked on a program to replace all of its coal-fired generation with new renewables, excluding large scale hydro. The two-year review of Ontario's Green Energy and Green Economy Act (GEA) of 2009 conducted by Ministry of Energy and the Ontario Power Authority concluded:

> "The FIT Program moved Ontario forward as a leader in clean energy. The program continues to be one of the best ways to attract investment, build clean energy and encourage local participation in the electricity sector. Ontario's clean energy initiatives have been a success, creating more than 20,000 jobs, on track to creating 50,000 jobs and attracting more than $27 billion in private-sector investment."

In the two years since the law was enacted, Ontario has already contracted 4,600 MW of renewable energy, has 2,900 MW in application, and is on track to meet the target of 10,700 MW of non-hydro renewable energy generation by 2015, all on line by 2018.

The same year Ontario passed this legislation, already resulting in 20,000 jobs, California passed SB 32, a much more modest Feed in Tariff bill designed to improve the existing but languishing AB 1969 program. Having authorized procurement totaling 750 MW, California spent those same two years and then some getting ready to implement the legislative remedy intended to accelerate procurement. CPUC ultimately adopted a process last month that limits its share of further procurement to roughly 3

[3] http://www.erneuerbare-energien.de/files/english/pdf/application/pdf/broschuere_ee_zahlen_en_bf.pdf
[4] http://www.erneuerbare-energien.de/english/current_press_releases/pm/48517.php

MW a month in three separate categories for the next two years, while extending the on line date for these projects to two years (with a further extension for regulatory delays). This modest procurement is expected to begin in 2013, the same year Ontario will complete its second two-year review. California has three times the population of Ontario -- a comparable program here would have already created 60,000 jobs and be adding over 3,000 MW every year to our renewable portfolio.

In the 1980's, the US and California led the world in wind energy generation and turbine production, but due to policy changes resulting in a dramatic drop in procurement, we gave up that lead to Europe and China. It is far easier to maintain a lead than regain one, and a strong local market will help maintain our current areas of leadership, such as research and commercialization of next generation PV collectors, distributed storage, forecasting, data management and related renewable integration technologies. California benefited for decades from farsighted investment in infrastructure and research. Renewable energy is a ready opportunity to bring about similar investment in our economy, environment, and industry leadership, to redirect energy payments back into the local economy, and attract private capital to support long term energy sustainability and price stability.

Responses to a few questions posed in the workshop

3) How many jobs, what types of jobs, and where do you expect jobs to be created by 2020?

- An additional 53,000 direct and in-direct jobs per year could be created by adopting a High DG approach to the RPS. WDG produces almost entirely in-state jobs.[5]
- A UCLA study of a proposal by the Los Angeles Business Council estimates 11,000 direct job-years in LA from a 600 MW FIT program. These jobs will all be within the city and do not account for induced and indirect jobs associated with this economic boost. More jobs per MW are created with distributed generation near load centers than larger projects, this job creation occurs more rapidly by avoiding lengthy permitting and interconnection delays or transmission builds, and directs investment much more evenly relative to population centers.[6]

[5] Wei and Kammen, 2010. ibid.
[6] http://issuu.com/uclapubaffairs/docs/labc_ucla_solarfit_study

- A UC Berkeley study calculates 33 job-years/MW of PV energy installed in the US. These jobs are in manufacturing and installation and specific to solar, which is job-intense. [7] Each renewable source has advantages and the state should pursue a balanced procurement approach. PV facilities have the most immediate employment benefits and then provide energy for decades with almost no additional cost.

4) What are the factors that would lead to an increase or decrease in job projections? (e.g., the health of the economy, out-of-state manufacturing incentives, global competition, and the effectiveness and coordination of California job training programs with local economic development)

- Reducing energy imports will increase California jobs. Any in-state energy investment produces in-state jobs, whereas money spent on imported energy sends ratepayer dollars to support jobs elsewhere.
- CLEAN programs lock in an electricity rate, usually for 20 years. This protection against rising fossil fuel rates adds long-term stability to household and business budgets, preserving jobs in all sectors.

13) What are California's competitive advantages and disadvantages in the creation of permanent jobs related to renewable energy development?

- Being, and remaining, the US leader in renewable energy will cause companies to come here first, other issues being equal, to be with the best. As the knowledge base and support economy become established, California's advantage will increase.
- Excellent solar and wind resources make success more likely.
- Large population means continuing demand.
- However, unclear procurement signals, combined with slow and unpredictable interconnection processes, discourage investment in California's renewable energy industry. SMUD's successful FIT program is an excellent example of how to employ efficient processes.

[7] http://stalix.com/Solar%20Energy%20Job%20Creation.pdf

16) What opportunities are there to leverage renewable energy development as an economic development tool in disadvantaged and/or environmental justice communities?

- Facilities development adds value and revenue streams to properties in the area, and increases commitment to those properties by owners.
- There are over 100,000 brownfield sites in California, with few immediate, cost-effective uses. See Project Navigator's presentation on the use of landfills and other brownfields for urban solar development.[8]
- Continuing, predictable development in or near EJ communities would naturally lead to hiring from those communities and support for green jobs training programs looking to place their graduates.
- Hiring locally reduces project costs related to labor transportation or temporary housing. It also creates better living conditions for employees, who enjoy a short commute and visible benefits from their own work.
- Beyond direct employment, indirect and induced employment can provide substantial and lasting benefits to the local community. WDG projects can purchase from local businesses, especially for non-specialized equipment and supplies. Experience in this supply market strengthens such businesses to enables them to successfully compete in further opportunities.
- Social benefits and economic development are eligible for EPIC funding. Therefore, apprenticeships and training in EJ communities could be a priority.

Thank you for your time and attention to this important topic. We look forward to further collaboration and a robust renewable economy for California and the country.

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[8] http://www.pvnavigator.com/downloads/PNL_Solar_Presentation_NBA_Atlanta_03-19-10.pdf

APPENDIX

CLEAN COALITION

Making Clean Local Energy Accessible Now

Local CLEAN Program Guide

Module 5: Estimating CLEAN Economic Benefits

November 2011

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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(SSW_27, 29 November 2011)

Table of Contents

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 economic benefits component of the local 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

This module of the Local CLEAN Program Guide provides approaches for estimating the economic benefits of a proposed CLEAN Program. Utilities rarely include these economic benefits in their avoided cost assessments because these benefits do not directly affect utilities or ratepayers and may not be easy to quantify. However, economic benefits are an important feature of CLEAN Programs that often motivate communities and their leaders to support the implementation of a new program or the expansion of an existing program.

CLEAN Programs bring the economic benefits of energy production to local communities, including job creation, capital investment, and local government revenues. CLEAN Programs spur the deployment of clean local energy by reducing the risks, costs, and timeframes of project development. By supporting local production of renewable energy, communities can keep energy production dollars in the local economy, allowing communities to avoid exporting those energy dollars for power and/or Renewable Energy Certificates (RECs) that are produced outside the local area, the state, or even the nation.

Communities can begin to realize these economic benefits almost immediately. In contrast to large-scale renewable energy projects, CLEAN projects become “shovel-ready” within months. Because CLEAN projects are relatively small-scale and can be deployed on existing buildings and previously disturbed lands within communities, these projects are not subject to the major delays associated with the development of large-scale projects.

Table A: Main Economic Benefits of CLEAN Programs:

- Job Creation
- Capital Investment
- Local Tax Revenues

The following sections describe the main economic benefits of CLEAN Programs and provide approaches for estimating the economic benefits of a proposed program. Section 5 highlights several tools for modeling economic benefits, while Appendix A provides an example of how the modeling tools in Section 5 can be applied.

2) Estimating Local Job Creation

CLEAN Programs are powerful engines for local job creation. Producing local renewable energy creates significantly more jobs than producing fossil fuel, nuclear energy, or central station renewable energy. Solar PV, which is one of the most common CLEAN technologies, contributes nearly nine times the number of jobs as coal or natural gas, and supports far more employment than central station renewable energy facilities.[i]

University of California, Berkeley (UC Berkeley) researchers found that a robust CLEAN Program for the State of California would create three times more jobs over a ten year period than the state's existing plan for meeting its renewable energy goals for two reasons: (i) more renewable energy would be purchased from within the state, and (ii) the CLEAN Program would increase procurement of energy from distributed solar photovoltaic (PV) facilities, which shifts investment away from transmission equipment and toward installation labor instead.[ii] Equally important, these jobs are created sooner due to the quick development potential of these smaller installations, which avoid the significant barriers to development that central station projects face, including frequent delays involved in the permitting and development of new transmission infrastructure, and often intense community opposition to projects located on pristine lands. This study relied on another UC Berkeley report, which created an analytical job projections model based on the review of 15 studies on the job creation potential of renewable energy, energy efficiency, and other low carbon resources.[iii] These two UC Berkeley studies highlight the importance of clearly defining job creation metrics so that the projections will be meaningful. The following definitions are especially helpful:

- One "job-year" is full time employment for one person for one year. "Job-years per gigawatt (GWh)" is the amount of job-years per GWh of renewable energy produced.[iv]
- "Direct" job creation includes employees hired by companies involved in the design, manufacturing, construction, installation, project management, delivery, operation, and maintenance of the new facilities.[v]
- "Indirect" job creation refers to the "supplier effect" of upstream and downstream suppliers. Indirect job creation includes employment by companies that provide goods and services to the direct employers. For example, the task of installing and maintaining wind turbines is a direct job, whereas transporting the wind turbines equipment is an indirect job. Similarly, an attorney employed by a solar company has a direct job, whereas an attorney employed by a law firm to provide services to solar companies has an indirect job.[vi]
- "Induced" employment refers to non-industry jobs, such as retail store clerks, created by the ripple effect of increased spending due to direct and indirect employment[vii] and local government employment facilitated by additional tax revenues. Additional local jobs are created by increased spending due to (i) income from locally-owned CLEAN projects, and (ii) ratepayer savings as avoided costs rise above the fixed costs associated with CLEAN energy.

It may also be useful to separately assess construction and operations period impacts. Construction-period impacts are short term; in contrast, operations-period impacts are annual impacts that accumulate over the life of the project. National Renewable Energy Laboratory researchers found that community wind projects have similar construction-period impacts as central station wind projects, but the operations period impacts of community wind projects are 1.5 to 3.4 times greater than those of central station projects.[viii]

Many respected organizations, such as the Center for American Progress and the National Renewable Energy Laboratory,[ix] have used input-output (I/O) models to estimate economic impacts of renewable energy policies. I/O models use the relationship between changes in demand and the resulting economic activity to estimate how new expenditures will impact economic development metrics including jobs, earnings, and economic activity.[x] It is worth noting that I/O models have significant limitations; they are static, linear, and do not take into account structural changes in the economy. However, they are very effective at providing a relative comparison between the baseline and the impact of a single alternative.[xi]

Another approach is to quickly estimate the job creation benefits of a proposed CLEAN Program based on the amount of new capacity of each renewable technology to be deployed as a result of a CLEAN Program, as shown in Table B below.

Table B: Average Direct Employment for Different Energy Technologies[xii]

Technology	Total Job Years per GWh
Biomass	0.21
Geothermal	0.25
Solar PV	0.87
Solar Thermal	0.23
Wind	0.17
Nuclear	0.14
Coal	0.11
Natural Gas	0.11

Source: Renewable and Appropriate Energy Laboratory, Energy Resources Group, University of California, Berkeley

Average direct employment multipliers for several energy technologies based on 15 studies. Renewable energy creates far more jobs than coal or natural gas.

It is important to note that the local community may not be the sole beneficiary of the economic benefits of a CLEAN Program. The renewable energy value chain is comprised of (i) upstream players, which include businesses that participate in research and development, product manufacturing, and distribution, and (ii) downstream players, which include companies that install and maintain renewable energy systems and distribute products directly to customers. A University of California, Los Angeles (UCLA) report asserted that it is more difficult to infer the local effects of a CLEAN Program on the upstream end of the renewable energy value chain.[xiii] There is strong evidence, however, that the upstream economic benefits of a robust CLEAN Program are significant.[xiv]

3) Estimating Capital Investment

The capital investment impacts of a CLEAN Program can be estimated with the same methods and models used to estimate job creation impacts. This section highlights a few additional issues relevant to estimating capital investment.

The capital investment impacts of a proposed program can be estimated in terms of the following metrics:

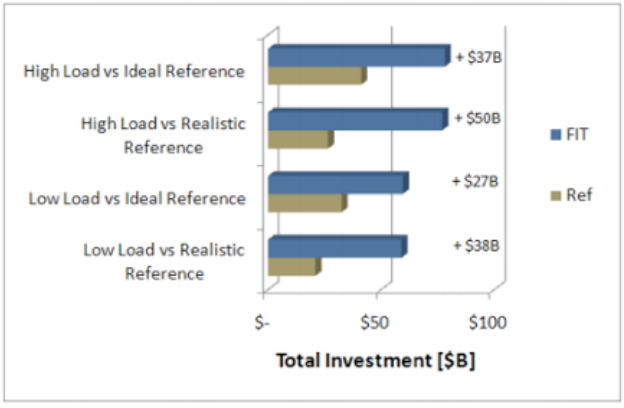
- How much new outside private investment will be attracted?
- How much local private capital will be reinvested in the community?
- How much public capital will be attracted?

CLEAN Programs increase public and private investment in the community by reducing the risks, costs, and timeframes of local renewable energy project development. In addition to attracting capital investment from outside parties, CLEAN Programs provide opportunities for local residents, banks, and businesses to reinvest capital in the community by leveling the playing field for project development. A study by the United States Government Accountability Office found that local ownership of projects increases the local economic benefits by 200% to 300%.[xv] To the extent that projects are built with local capital, the return on investment from CLEAN projects comes directly back to community members, who generally spend and reinvest a large portion of those returns in the local economy.

CLEAN Programs also attract federal (and, where available, state) investment grants, investment tax credits, and accelerated depreciation allowances for facilities. The Database of State Incentives for Renewables & Efficiency (DSIRE) includes up-to-date information on state, local, utility, and federal renewable energy incentives and policies.[xvi] Well-designed CLEAN Programs allow CLEAN project developers to take advantage of federal and state incentives.

As shown in Figure 1, which was included in the UC Berkeley report described above, a robust state-wide CLEAN Program would result in up to $50 billion additional clean energy investment in California over the next decade compared to the reference approach for meeting renewable energy targets. The 30% federal investment tax credit alone would translate into an additional $15 billion flowing into California from federal tax credits because of a CLEAN Program.[xvii]

Figure 1: Private Investment under a CLEAN Program ("FIT") vs. Reference Case from 2011-2020[xviii]



Source: University of California, Berkeley, Renewable and Appropriate Energy Laboratory, Energy Resources Group
Amounts are undiscounted in 2009 dollars

4) Estimating Local Tax Revenues

Capital investment in the community and local job creation creates new sources of local tax revenues, as described in Table B below. Utility policymakers should consult with their local tax department to determine which of these potential sources are available in their community.

Table C: Potential Sources of Local Tax Revenues:

Type	Description
Sales and/or use taxes	Local purchases of goods and services in connection with construction, installation, operation, and maintenance of CLEAN facilities Local purchases of renewable energy equipment Local purchases of goods and services caused by increased local employment, capital investment, and reinvested CLEAN energy income
Income taxes	Income from increased local employment Income from CLEAN energy sales
Personal property taxes	Assessed value of CLEAN facilities equipment
Real property taxes	Increased real property values due to installation of CLEAN facilities

UC Berkeley researchers projected the additional state revenues that would be generated by a CLEAN Program for California by (i) estimating the installed cost per kilowatt for each renewable technology, (ii) estimating the number of kilowatts of each renewable technology that would be installed, (iii) dividing the installed cost of each renewable technology into the estimated costs of "materials, labor, and other", (iv) assuming certain state sales, income, and property tax rates, annual cost of materials, and annual depreciation, and (v) assuming that all construction and installation costs would be in-state.[xix]

It is important to note that a CLEAN Program will only result in positive fiscal impacts on local government budgets, because CLEAN Programs are entirely driven by private investment, not by state or local rebates, subsidies, or other incentives. A significant benefit of CLEAN Programs is that they leverage private investment dollars to meet community goals by reducing the costs, risks, and timeframes for renewable energy project development.

5) Modeling the Economic Impact

Program designers may model the economic impact of a proposed CLEAN Program by using the modeling tools described below. Additional proprietary tools are also widely available. The Clean Coalition makes no express or implied endorsement of any modeling tool.

NREL's Jobs and Economic Development Impacts (JEDI) model

The Jobs and Economic Development Impact (JEDI) models are free tools developed by the National Renewable Energy Laboratory (NREL) and used by county and state policymakers, public utility commissions, and potential project owners to estimate the potential economic impacts associated with constructing and operating power generation plants at the local level. The location-specific default values in the JEDI models were derived from the Minnesota IMPLAN Group (MIG) and NREL's extensive interviews with power generation project developers, state tax representatives, and others in the electric power industry.[xx] To run a JEDI model using Excel, basic information about a project, including state, location, year of construction, and facility size must be input by the user. The model estimates project costs and economic impacts in terms of jobs and earnings, as well as the value of energy produced.[xxi] The Appendix shows an example of how the JEDI model can be used to estimate the economic benefits of a local solar CLEAN Program.

The UC Berkeley Green Jobs Calculator

The UC Berkeley Green Jobs Calculator is a free Excel spreadsheet model that includes multipliers for estimating the number of direct and indirect job-years that will be created by each new gigawatt hour (GWh) hour of renewable energy production.[xxii]

RIMS II

The U.S. Department of Commerce's Bureau of Economic Analysis (BEA) has created a methodology for estimating regional input–output multipliers called Regional Input–Output Modeling System (RIMS II). RIMS II is used to estimate how much a one-time or continuing increase in economic activity will be supplied by local industries. Several types of multipliers are provided by RIMS II. Final-demand multipliers are provided for output, earnings, employment, and value added, and direct-effect multipliers are provided for earnings and employment. RIMS II costs $275 per region and $75 per industry.[xxiii]

IMPLAN

IMPLAN is a modeling tool used by government agencies, colleges and universities, nonprofit organizations, corporations, and community planning organizations to create input–output models that quickly and efficiently model economic impacts. IMPLAN is a commercially available software package; prices vary by county, state, year, etc. The IMPLAN software generates regional purchase coefficients in order to estimate the portion of demand for a good or service that is met locally.[xxiv]

Regional Economic Models Inc. (REMI)

The Regional Economic Models Inc. (REMI) model is a sophisticated forecasting and policy analysis tool that combines a robust input–output component to display relationships between industries with three additional modeling approaches: (i) general equilibrium, (ii) econometrics, and (iii) New Economic Geography. The REMI model can account for dynamic changes in the economy over time, including fluctuations in prices, wage levels, migration, productivity. A free demonstration of REMI can be downloaded from the company's website.[xxv]

References for Module 5

[i] Ditlev Engel and Daniel M. Kammen, written for the Copenhagen Climate Council, "Green Jobs and the Clean Energy Economy," 2009, *available at* http://rael.berkeley.edu/sites/default//files/old-site-files/TLS%20Four_May2209_1.pdf.

[ii] Daniel Kammen and Max Wei, Renewable and Appropriate Energy Laboratory, Energy Resources Group, University of California, Berkeley, "Economic Benefits of a Comprehensive Feed-in Tariff: An Analysis of the REESA in California," pg. 9-15, July 7, 2010, *available at* http://www.clean-coalition.org/storage/resources/studies/economic-benefits-of-a-fit/economic_benefits_of_a_comprehensive_feed-in_tariff-july072010.pdf.

[iii] Max Wei, Shana Patadia, and Dan Kammen, Renewable and Appropriate Energy Laboratory, Energy Resources Group, University of California, Berkeley, "Putting Renewables and Energy Efficiency to Work: How many jobs can the clean energy industry generate in the U.S.?," January 18, 2010, *available at* http://rael.berkeley.edu/node/585.

[iv] Ibid.

[v] Ibid.

[vi] Ibid; See also University of Wisconsin Extension: Cooperative Extension and Wischonsin Hospital Association, Inc, "Healthy Hospitals. Healthy Communities: The economic impact of Wisconsin's hospitals," pg. I, *available at* http://www.uwex.edu/ces/cced/economies/documents/HealthyHospitals_web.pdf.

[vii] Ibid; See also, Ibid.

[viii] E. Lantz and S. Tegen, National Renewable Energy Laboratory, "Economic Development Impacts of Community Wind Projects: A Review and Empirical Evaluation," April 2009, *available at* http://www.nrel.gov/docs/fy09osti/45555.pdf.

[ix] Ibid.

[x] Ibid.

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Appendix: Modeling CLEAN Economic Benefits

This appendix illustrates how to estimate the local economic benefits of a CLEAN Program by using the National Renewable Energy Laboratory's (NREL's) Jobs and Economic Development Impact (JEDI) model, plus a supplemental analysis to reflect the benefits of local ownership of CLEAN projects. The JEDI model is only one of several models that may be used to estimate local economic benefits.

This modeling process resulted in the following estimate of the local economic benefits of a 10 megawatt commercial rooftop solar photovoltaic program in Arizona:

- During construction, $47,311,000 in additional local economic activity (direct and induced), including the creation of 465 local job-years (direct and induced)
- Over the first 20 years of operations, $59,600,000 in additional local wages and investment income (direct), reflecting the creation of 230 local job-years (direct and induced)

The modeling process involved the following steps:

1) The basic project data and selected default JEDI industry averages data, shown in Table 1 on the following page, was input by the user into the JEDI model Excel spreadsheet.

2) The JEDI model generated the estimates of the local economic impacts of the program shown in Table 2.

3) Since CLEAN projects are generally locally-owned, the significant economic benefits of local income derived through local ownership or financing of projects should be considered. An NREL study found that local ownership increases the local economic benefits by 1.5 to 3.4 times during the operations period.[i] Since the JEDI model does not reflect the significant economic impacts of local ownership, the JEDI results in Table 2 below have been supplemented with the following analysis:

- If the projects are owned by local investors, a 7% annual return on investment for $41.5 million of installation costs will result in $2,905,000 of additional local income per year ($58,100,000 over 20 years).
- By applying the default JEDI formula for calculating the induced effects of labor income, we estimated that $2,905,000 of local income will result in local induced employment supporting an additional 10 full-time equivalents throughout the initial 20 years of project operation (200 job-years).
- As local project investment capital is repaid and reinvested in the community, additional induced economic benefits would accrue. These benefits are not included in the summary of economic benefits above.
- Continuing operation after 20 years may result in higher returns on investment for local investors and greater annual economic impacts. These benefits are not included in the summary of economic benefits above.

Table 1: JEDI Project Data Input Summary (Solar Photovoltaic Program)

Project Location	Arizona
Year of Construction	2010
Average System Size - DC Nameplate Capacity (kW)	100
Number of Systems Installed	100
Total Program Size - DC Nameplate Capacity (kW)	10,000 kW
System Type	Commercial Rooftop
Base Installed System Cost ($/kWDC)	$4,000
Annual Direct Operating and Maintenance Costs ($/kW)	$10.00
Money Value - Current or Constant (Dollar Year)	2008
Project Construction or Installation Cost	$41,487,200
Local Spending	$31,547,740
Total Annual Operational Expenses	$4,740,000
Direct Operating and Maintenance Costs	$100,000
Local Spending	$74,045
Other Annual Costs	$4,640,000
Local Spending	$0
Debt and Equity Payments	$2,370,000
Property Taxes	$0

Table 2: JEDI Results Summary (Solar Photovoltaic Program)

During Construction Period			
Types of Impact	**Jobs**	**Earnings ($ thousand)**	**Output ($ thousand)**
Project Development and Onsite Labor Impacts	119.5	$5,595	$10,794
Construction and Installation Labor	25.5	$2,000	
Construction and Installation Related Services	94	$3,595	
Module and Supply Chain Impacts	237	$11,359	$27,705.5
Induced Impacts	108.5	$4,425	$8,812
Total Impacts	**465**	**$21,379**	**$47,311**
During Operating Years			
Types of Impact	**Annual Jobs**	**Annual Earnings ($ thousand)**	**Annual Output ($ thousand)**
Onsite Labor Impacts			
PV Project Labor Only	1	$51	$51
Local Revenue and Supply Chain Impacts	0.5	$16	$40
Induced Impacts	0.0	$8	$15.5
Total Annual Impacts	1.5	$75	$106.5
Total Impacts Over 20 Years	**30**	**$1,500**	**$2,130**

Notes regarding Table 2:[ii]

- "Earnings" refer to wages and salaries. "Output" refers to all economic activity related to the program.
- Jobs are full-time equivalent for a period of one year.
- Results are based on model default values. Totals may not add up due to independent rounding.

References for Appendix

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