CLEAN COALITION
Making Clean Local Energy Accessible Now

Local CLEAN Program Guide

Module 5: Estimating CLEAN Economic Benefits

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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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.

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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:

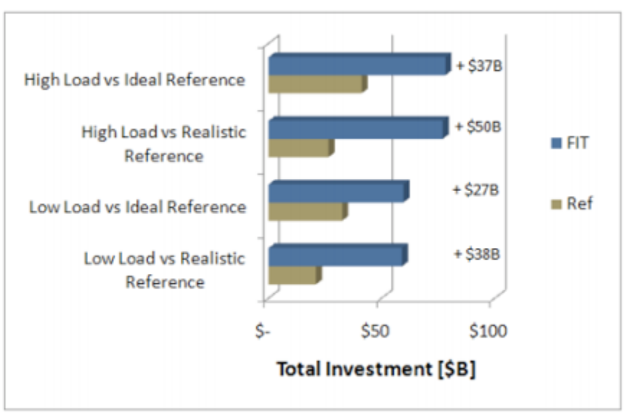
- How much new outside private investment will be attracted?
- How much local private capital will be reinvested in the community?
- How much public capital will be attracted?

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.

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[xi] Robert Pollin, James Heintz, and Heidi Garrett-Peltier, Center for American Progress and the Political Economy Research Institute (PERI), University of Massachusetts, Amherst, June 2009, *available at* http://www.americanprogress.org/issues/2009/06/pdf/peri_report.pdf.

[xii] 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.?,” pg. 923, January 18, 2010.

[xiii] Los Angeles Business Council (LABC) and the University of California, Los Angeles (UCLA) Luskin Center for Innovation School of Public Affairs, “Designing an Effective Feed-in Tariff for Greater Lost Angeles,” pg. 45, 2009, *available at* http://www.labusinesscouncil.org/online_documents/2010/Designing-an-Effective-Feed-in-Tariff-for-Greater-Los-Angeles-040110.pdf.

[xiv] Germany’s CLEAN program has produced significant economic benefits. In 2010, gross employment in Germany from the manufacture of renewable energy facilities was approximately 234,100, a 12% increase since 2009. Source: Marlene O’Sullivan, et al., Institut fur Technische Thermodynamik, Gross Employment From Renewable Energy in Germany – A First Estimate, pg. 4 2011.

[xv] United States Government Accountability Office (GAO), Report to the Ranking Democratic Member, Committee on Agriculture, Nutrition, and Forestry, U.S. Senate,“Wind Power’s Contribution to Electric Power Generation and Impact on Farms and Rural Communities,” GAO-04-756, September 2004, *available at* http://www.gao.gov/new.items/d04756.pdf.

[xvi] Database of State Incentives for Renewables & Efficiency, U.S. Department of Energy, Interstate Renewable Energy Council, and North Carolina Solar Center, 2011, *available at* http://www.dsireusa.org/summarytables/finre.cfm.

[xvii] Daniel Kammen and Max Wei, "Economic Benefits of a Comprehensive Feed-in Tariff: An Analysis of the REESA in California," pg. 19.

[xviii] Ibid.

[xix]Ibid.

[xx] National Renewable Energy Laboratory (NREL), Jobs and Economic Development Impact (JEDI), "About JEDI Models," 2011, *available at* http://www.nrel.gov/analysis/jedi/about_jedi.html.

[xxi] National Renewable Energy Laboratory (NREL), Jobs and Economic Development Impact (JEDI), "Methodology," 2011, *available at* http://www.nrel.gov/analysis/jedi/methodology.html.

[xxii] Renewable and Appropriate Energy Laboratory, Energy Resources Group, University of California, Berkeley, "Green Jobs," 2011, *available at* http://rael.berkeley.edu/greenjobs.

[xxiii] U.S. Department of Commerce, Bureau of Economic Analysis, "Regional Input-Output Modeling System (RIMS II)," 2011, *available at* http://www.bea.gov/regional/rims.

[xxiv] IMPLAN Economic Modeling, 2011, *available at* http://implan.com/V4/Index.php.

[xxv] Regional Economic Models, Inc. (REMI), 2011, *available at* http://www.remi.com.

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

[i] E. Lantz and S. Tegen, National Renewable Energy Laboratory, "Economic Development Impacts of Community Wind Projects: A Review and Empirical Evaluation," pg. 10, April 2009, *available at* http://www.nrel.gov/docs/fy09osti/45555.pdf.

[ii] A guide to interpreting JEDI results is available at http://www.nrel.gov/analysis/jedi/results.html.