



California Energy Commission IEPR Lead Commissioner Workshop



Jobs and Renewable Energy in California

“Analyzing Job Impacts Using NREL’s JEDI Models”

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*Energy, jobs and economic development
are very much connected.*



What is JEDI?

- **J**obs and **E**conomic **D**evelopment **I**mpact models
- Spreadsheet-based tools developed for the National Renewable Energy Laboratory (NREL)
- Designed to calculate local economic impacts associated with the installation and annual operations of energy generating systems



JEDI Models

<http://www.nrel.gov/analysis/jedi/>

Renewable Energy

- Solar – Photovoltaic (PV)
 - Concentrated Solar Power (CSP)
- Wind – Onshore Large
- Hydro – Marine Hydrokinetic
- Biofuels – Corn Ethanol
 - Cellulosic Ethanol

Conventional Energy

- Natural Gas
- Coal

JEDI Models (in development)

- Solar – Photovoltaic (PV) Scenario
- Wind – Small Wind and Offshore Wind
- Biopower
- Geothermal
- Conventional Hydro
- Petroleum
- Transmission

JEDI: Key Design Elements

- Tool to easily identify statewide economic impacts of constructing and operating energy systems
- Available to a broad range of people
- Default data that can be easily modified
- Flexible input options
- User Add-in Location feature (for county or regional analysis)

Who Uses JEDI Models?

- Resource Planners and Analysts
- Project Developers
- Renewable Energy Advocates
- Local Planning Depts.
- State Energy Offices
- State and Local Economic Development Commissions
- Researchers (government, university, etc.)

JEDI Project Analysis:

It all begins with a specific project.

The User inputs.....

Minimum Information	or	More Detailed Information
<ul style="list-style-type: none">• Location (State or County*)• Year of construction• System Type (for PV)<ul style="list-style-type: none">Residential NewResidential RetrofitSmall CommercialLarge CommercialUtility• Size of PV system (KW)		<p>Installation</p> <ul style="list-style-type: none">• Materials and Equipment Costs (modules, mounting, electrical, etc.)• Labor Costs• Other Costs (permits, services, overhead, etc.) <p>Annual Operating & Maintenance</p> <ul style="list-style-type: none">• Labor Costs• Materials and Equipment Costs <p>Other Parameters (Financial, Tax, and Payroll)</p>

*requires additional input-output data

Methodology

Input-Output - Multiplier Analysis

“Input-output analysis can be thought of as a method of evaluating and summing the impacts of a series of effects generated by an expenditure (i.e., input).”

To determine the total effect of constructing/installing a system ...

Three separate impacts are examined for each expenditure:

- ✓ **Direct**
- ✓ **Indirect**
- ✓ **Induced**

JEDI Economic Impacts

Economic “ripple effect”

Onsite Impacts

These are jobs related to project development and onsite installation expenditures; including **system installers, electricians, designers, engineers,** and other installation **service providers.**

Local Revenue and Supply Chain Impacts

These are offsite jobs at support businesses, such as **banks** financing the installation, **retail** and **wholesale material** and **equipment suppliers,** and at **manufacturers** and their **suppliers.**

Induced Impacts

These jobs are at local **retail stores, grocery stores, gas stations, banks, child care centers,** and other **services** and **industries** benefitting from the household spending (of wages) by people directly and indirectly supported by the project.

“The benefits that are ultimately generated by expenditures for energy systems depend upon the extent to which those expenditures are spent locally and the structure of the local economy.”

And then.....

Changes in expenditures (demand) are matched with their appropriate multipliers for each industry sector affected by the change in expenditure.

State specific multipliers and personal expenditure patterns are used to generate the results. The multipliers for

- employment**
- wage and salary income**
- output (economic activity)**
- personal expenditure patterns**

are derived using the IMPLAN model.*

*IMPLAN is a social accounting and impact analysis tool developed by the Minnesota IMPLAN Group (MIG, Inc), Hudson, Wisconsin (implan.com).

Summary Results

Project Data	Impacts
<ul style="list-style-type: none">• Project Installation Costs (total and local share)• Annual O&M Spending• Debt Payments• Property and Sales Tax	<div>Construction Period</div> <ul style="list-style-type: none">• Jobs• Earnings• Output <div>Operating Years (annual)</div> <ul style="list-style-type: none">• Jobs• Earnings• Output

Some Important Points to Keep in Mind.....

–The assumptions used in the analysis play an important role in influencing the results.

–Project size, location, financing arrangements and site-specific factors influence the installation and operating costs.

–The model is designed to incorporate model default values or new values entered by the user.

More Points to Keep in Mind.....

- Model default values represent a reasonable expenditure pattern for installing and operating the various size systems within a state (in the United States) and the share of expenditures spent locally.*
- The availability of local resources, including labor and materials and locally manufactured equipment and other components, can have a significant effect on the costs and the economic benefits that accrue to the state or region being analyzed.

*Local share” values can be revised to localize the model.

“To the extent the user has and can incorporate project specific data, and the share of spending that is expected to occur locally, the more localized the impact analysis will be.”

**And now let's take a
look at one of the models.....**

Photovoltaic Project Data

Please read instructions before getting started

INSTRUCTIONS:

1. Begin by entering *Project Location* (from pull-down list) and other *Project Descriptive Data* relevant to your particular project. After inputting Descriptive Data press enter (or cursor to the next cell) to continue.
2. Once *Descriptive Data* is complete, you may choose to utilize the detailed model default values for *Project Cost* (based on your *Descriptive Data*) by choosing "Y" on line 26 OR you may choose to use your own values entered (modified) under *Project Cost Data* by choosing "N" on line 26. Choose "Y" to accept *Project Cost* default values or "N" to over-ride *Project Cost* default values and use your own inputs.
3. Press 'Go To Summary Impacts' Button

NOTES: Additional information is available by pointing to the red triangles located in cell corners. Only those cells with a white background can accept new values.

Project Descriptive Data

Project Location	CALIFORNIA	
Year of Construction or Installation	2012	
System Application	Residential Retrofit	
Solar Cell/Module Material	Crystalline Silicon	
System Tracking	Fixed Mount	
Average System Size - DC Nameplate Capacity (kW)	5.0	Typically less than 10 kW
Number of Systems Installed	100.0	
Total Project Size - DC Nameplate Capacity (kW)	500.0	
Base Installed System Cost (\$/kW _{DC})	\$6,561	
Annual Direct Operations and Maintenance Cost (\$/kW)	\$32.80	
Money Value (Dollar Year)	2010	
Utilize <i>Project Cost Data</i> default values? Choose "Y" to accept model default values or "N" to view the default values and utilize new user defined values (entered below).	Y	Press 'Go To Summary Impacts' Button

Go To Summary Impacts

Project Cost Data

Installation Costs	Cost	Cost Per kW	Percent of Total Cost	Purchased Locally (%)	Manufactured Locally (Y or N)
Materials & Equipment					
Mounting (rails, clamps, fittings, etc.)	\$114,991	\$230	3.4%	100%	N
Modules	\$1,074,912	\$2,150	31.6%	100%	N
Electrical (wire, connectors, breakers, etc.)	\$114,991	\$230	3.4%	100%	N
Inverter	\$209,983	\$420	6.2%	100%	N
Subtotal	\$1,514,876	\$3,030	44.5%		
Labor					
Installation	\$275,113	\$550	8.1%	100%	
Subtotal	\$275,113	\$550	8.1%		
Total	\$1,789,989	\$3,580	52.6%		
Other Costs					
Permitting	\$91,863	\$184	2.7%	100%	
Other Costs	\$183,727	\$367	5.4%	100%	
Business Overhead	\$1,215,121	\$2,430	35.7%	100%	
Subtotal	\$1,490,711	\$2,981	43.8%		
Subtotal	\$3,280,700	\$6,561	96.3%		
Sales Tax (Materials & Equipment Purchases)	\$124,977	\$250	3.7%	100%	
Total	\$3,405,678	\$6,811	100.0%		

PV System Annual Operating and Maintenance Costs

	Cost	Cost Per kW	Percent of Total Cost	Local Share (%)	
Labor					
Technicians	\$8,965	\$17.93	52.7%	100%	
Subtotal	\$8,965	\$17.93	52.7%		
Materials and Services					
Materials & Equipment	\$7,435	\$14.87	43.7%	100%	N
Services	\$0	\$0.00	0.0%	100%	
Subtotal	\$7,435	\$14.87	43.7%		
Sales Tax (Materials & Equipment Purchases)	\$613	\$1.23	3.6%	100%	
Total	\$17,013	\$34.03	100.0%		

Other Parameters

Financial Parameters

Debt Financing

Percentage financed

80%

Years financed (term)

10

Interest rate

5%

Local Share

0%

Tax Parameters

Local Property Tax (percent of taxable value)

0%

Assessed Value (percent of construction cost)

0%

Taxable Value (percent of assessed value)

0%

Taxable Value

\$0

Property Tax Exemption (percent of local taxes)

100%

Local Property Taxes

\$0

100%

Local Sales Tax Rate

8.25%

100%

Sales Tax Exemption (percent of local taxes)

0%

Payroll Parameters

Construction and Installation Labor

Construction Workers / Installers

Wage per hour

\$21.39

Employer Payroll Overhead

45.6%

O & M Labor

Technicians

Wage per hour

\$21.39

Employer Payroll Overhead

45.6%

Local Economic Impacts - Summary Results

	Jobs	Earnings \$000 (2010)	Output \$000 (2010)
During construction and installation period			
Project Development and Onsite Labor Impacts			
Construction and Installation Labor	4.2	\$275.1	
Construction and Installation Related Services	6.7	\$313.9	
Subtotal	11.0	\$589.0	\$1,048.0
Module and Supply Chain Impacts			
Manufacturing Impacts	0.0	\$0.0	\$0.0
Trade (Wholesale and Retail)	2.9	\$178.6	\$538.6
Finance, Insurance and Real Estate	0.0	\$0.0	\$0.0
Professional Services	2.0	\$100.4	\$339.6
Other Services	3.2	\$224.3	\$777.2
Other Sectors	4.5	\$164.7	\$381.6
Subtotal	12.6	\$668.0	\$2,036.9
Induced Impacts	8.6	\$380.3	\$1,351.1
Total Impacts	32.2	\$1,637.3	\$4,436.1
	Annual	Annual	Annual
	Jobs	Earnings	Output
During operating years		\$000 (2010)	\$000 (2010)
Onsite Labor Impacts			
PV Project Labor Only	0.1	\$8.3	\$8.3
Local Revenue and Supply Chain Impacts	0.1	\$3.2	\$10.4
Induced Impacts	0.0	\$2.0	\$7.1
Total Impacts	0.2	\$13.5	\$25.9

Notes: Earnings and Output values are thousands of dollars in year 2010 dollars. Construction and operating period jobs are full-time equivalent for one year (1 FTE = 2,080 hours). Economic impacts "During operating years" represent impacts that occur from system/plant operations/expenditures. Totals may not add up due to independent rounding.

- JEDI analyses are performed in **various** ways:
 - Statewide impacts (one state or comparison of several)
 - Countywide impacts
 - Individual system or grouped systems
 - Compared to natural gas, coal or other renewables
 - Precise assumptions vs. ranges and sensitivities
 - Local vs. non-local ownership and local “optimization”
 - Comparison of tax parameters

JEDI

Jobs and Economic Development Impact Model

**National Renewable Energy Laboratory
Available at <http://www.nrel.gov/analysis/jedi/>**

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