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12-IEP-1D

DATE MAY 30 2012

RECD. MAY 31 2012

WORKFORCE NEEDS FOR THE NEW ENERGY ECONOMY



Center for Energy Efficiency & Renewable Technologies

Research by Rhonda S. Mills, Alexandra Kravetz and Ryan Drobek

Presented to the California Energy Commission - IEPR Lead Commissioner Workshop
Jobs and Renewable Energy in California

May 30, 2012



Southern California Survey Focus

The region is an excellent illustration of economic development coming from the clean energy sector.

- SoCal has the best combination of renewable “fuels” in North America.
- Next to large populations with huge electricity demands.

Best in Class:

The world’s most-experienced and innovative renewable energy companies are proposing to build dozens of clean powerplants in Southern California.



Tehachapi Wind

Second-best wind resource in the state.

Vast amounts untapped.

4,000+ MW in pipeline.



Mohave Solar

Only the Sahara Desert and Chilean Andes have better solar fuel.

8,000+ MW pending permit applications

Kern, San Bernardino, Riverside, San Diego and SLO Counties.



Salton Sea and Mammoth Lakes Geothermal

Geothermal is 24/7 Baseload Power.
It replaces Coal and Nuclear.

Imperial County has 2,000 MW
potential to tap.

Mammoth Lakes and the Geysers
rich in reservoirs. Several projects in
development.



BIOMASS

TURNING WASTE PRODUCTS INTO ELECTRICITY AND FUEL



San Joaquin Valley and Ag-Community Biomass - BioMethane

AG – FOREST – ANIMAL – MUNICIPAL WASTE STREAMS

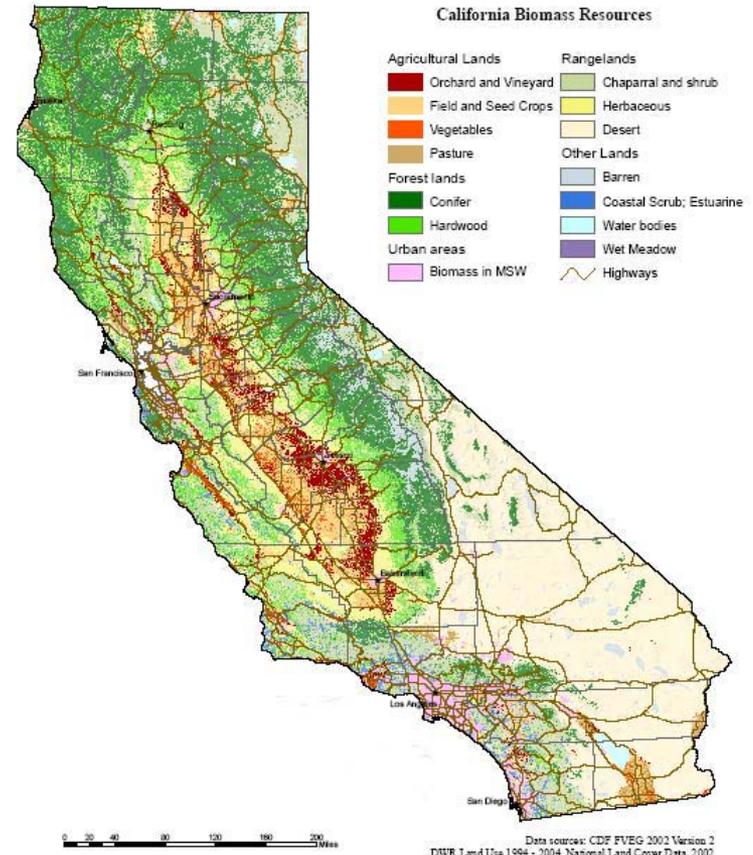
Biomass is 24/7 Baseload Power.

*It also replaces Coal and supplements
Natural Gas resources.*

California has 1,000ss of MW
potential using a variety of clean
electric generators.

**WASTE CONVERSION ELIMINATES
LANDFILLS AND WASTE STREAMS
AND KEEPS RESOURCES LOCALIZED**

Center for Energy Efficiency and Renewable Technologies
May 30, 2012





CALIFORNIA BIOMASS FACILITIES

- Direct Combustion Power Plants
 - * Direct Combustion Biomass
 - * Direct Combustion MSW
- Digesters
 - ▼ Animal Waste Digester - Dairy
 - ▼ Animal Waste Digester - Swine
 - ▼ Food Waste Digester
 - ▼ Wastewater Treatment (Biogas)
 - ▼ Wastewater Treatment (Energy)
- Landfill Gas to Energy
 - ▲ LF GTE (Electricity)
 - ▲ Landfill Gas to Heat
 - ▲ Landfill Gas Planned Facility
- Highway

BIOMASS FACILITIES THROUGHOUT CALIFORNIA

Biomass tends to be co-located with industrial facilities and/or the Users of the Energy/Fuel.

0 25 50 100 150 200 Miles

Data sources: California Energy Commission, PIER Program, 2004
 CDMMB Solid Waste Information System (S.WIS), 2005
 Environmental Protection Agency, Region 9, 2004
 September 15, 2006, L.D. via

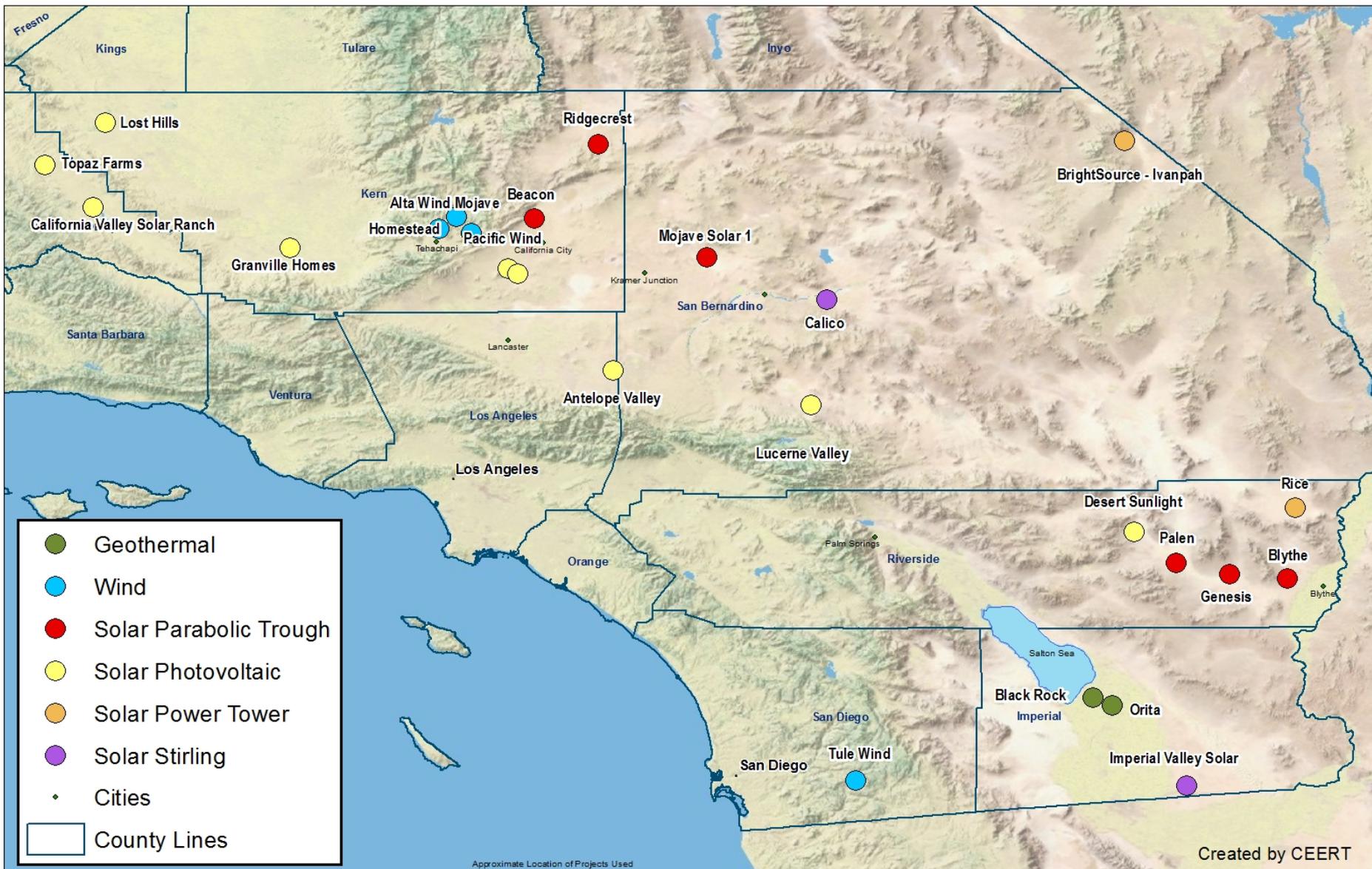
DISTRIBUTED GENERATION TECHNOLOGIES

FUEL CELLS, CLEAN ENGINES, MICROTURBINES AND OTHER TECHNOLOGIES
CAN BE LOCATED AT A CUSTOMER'S FACILITY



Stationary Fuel Cells





Key Renewable Projects 2010-2011 and the CEERT Survey Region



CEERT SURVEYED 14 CLEAN ENERGY DEVELOPERS IN SOCAL WE ASKED:

1. What Kind of Workforce is Needed to Build Your Project?
2. How Many People are Needed?
3. How Long Will It Take to Build the Project?
4. What Type of Workforce is Needed to Operate the Plant After It Is Built?
5. How Long Will the Powerplant Operate?



Photo: EngineerLive.com



Photo: Ashhurst Engineering & Construction

WHAT WE LEARNED ABOUT 14 CLEAN POWER PROJECTS:

The clean energy build-out requires a large workforce.

Thousands of workers are needed at the 14 sites in Southern California between 2010-2015 to build the powerplants.

Hundreds of Operations and Maintenance jobs are needed for the next 20-30 years.

Skilled and general laborers, project managers, equipment operators, engineers and office personnel will run the plants.



GEOHERMAL & WIND CONSTRUCTION WORKFORCE NEEDS

DEVELOPER	TECHNOLOGY	PROJECT NAME	MW SIZE	AVG # JOBS	EMPLOYMENT LENGTH
				FTEs PER MONTH	
GEOHERMAL					
CALENERGY	Geothermal	Black Rock 1-3	162	323	4 YEARS
RAM POWER	Geothermal	Orita 1	49	90	3 YEARS
WIND					
ENXCO	Wind	Pacific Wind	250	318	3 YEARS
HORIZON WIND	Wind	Homestead	100	159	1 YEAR
TERRAGEN	Wind	Alta Wind 1 Mohave	720	250	1.5 YEARS
TOTAL			1,281 MW	1,140 JOBS/MONTH COMBINED	1-3 YEARS

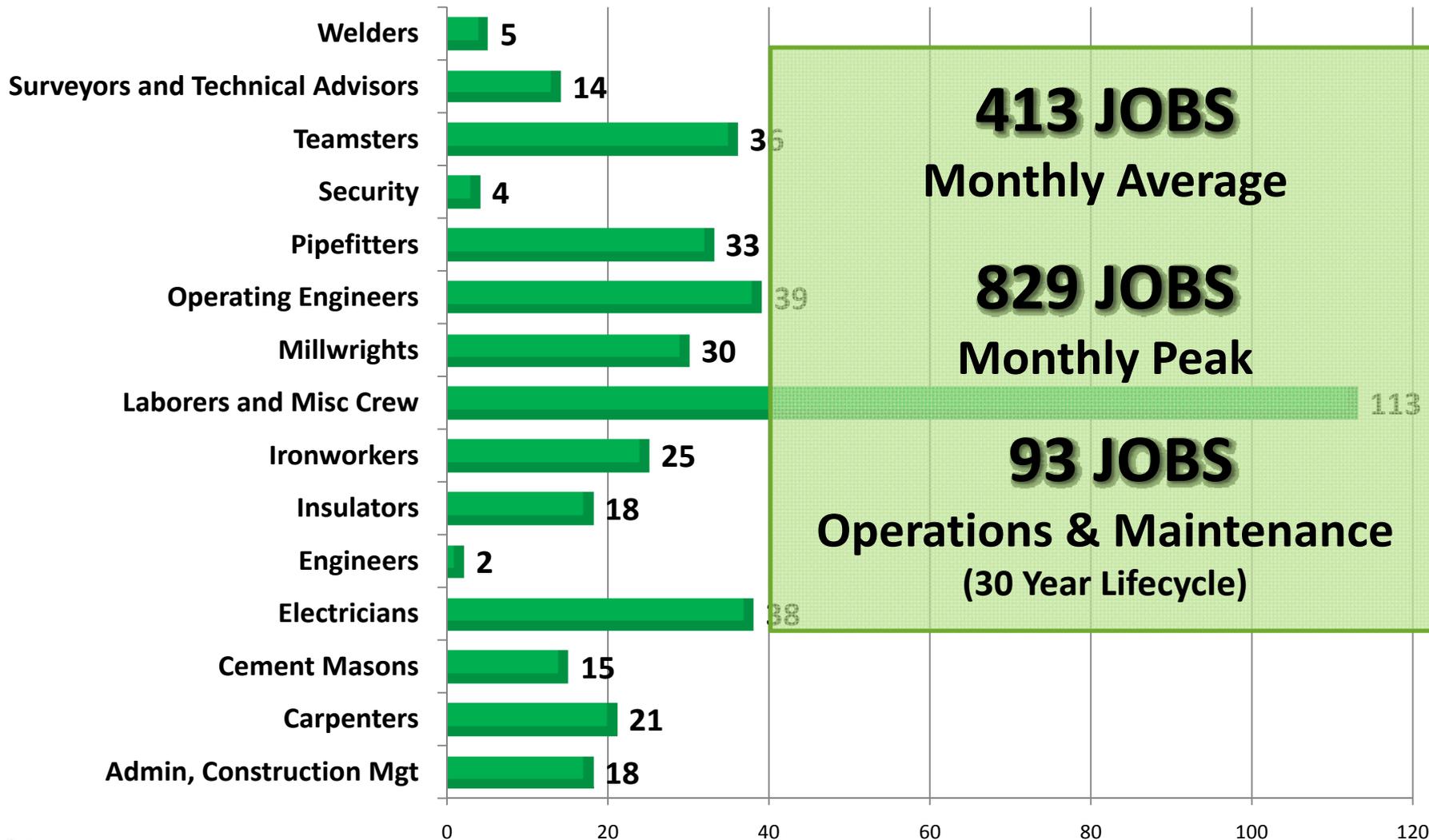
The survey is a sample, not a census, of all the projects being developed. Prepared by Center for Energy Efficiency & Renewable Technologies



Monthly Construction Jobs Estimates

2 Geothermal Projects: 211 MW

Length of Construction: 3 – 4 Years

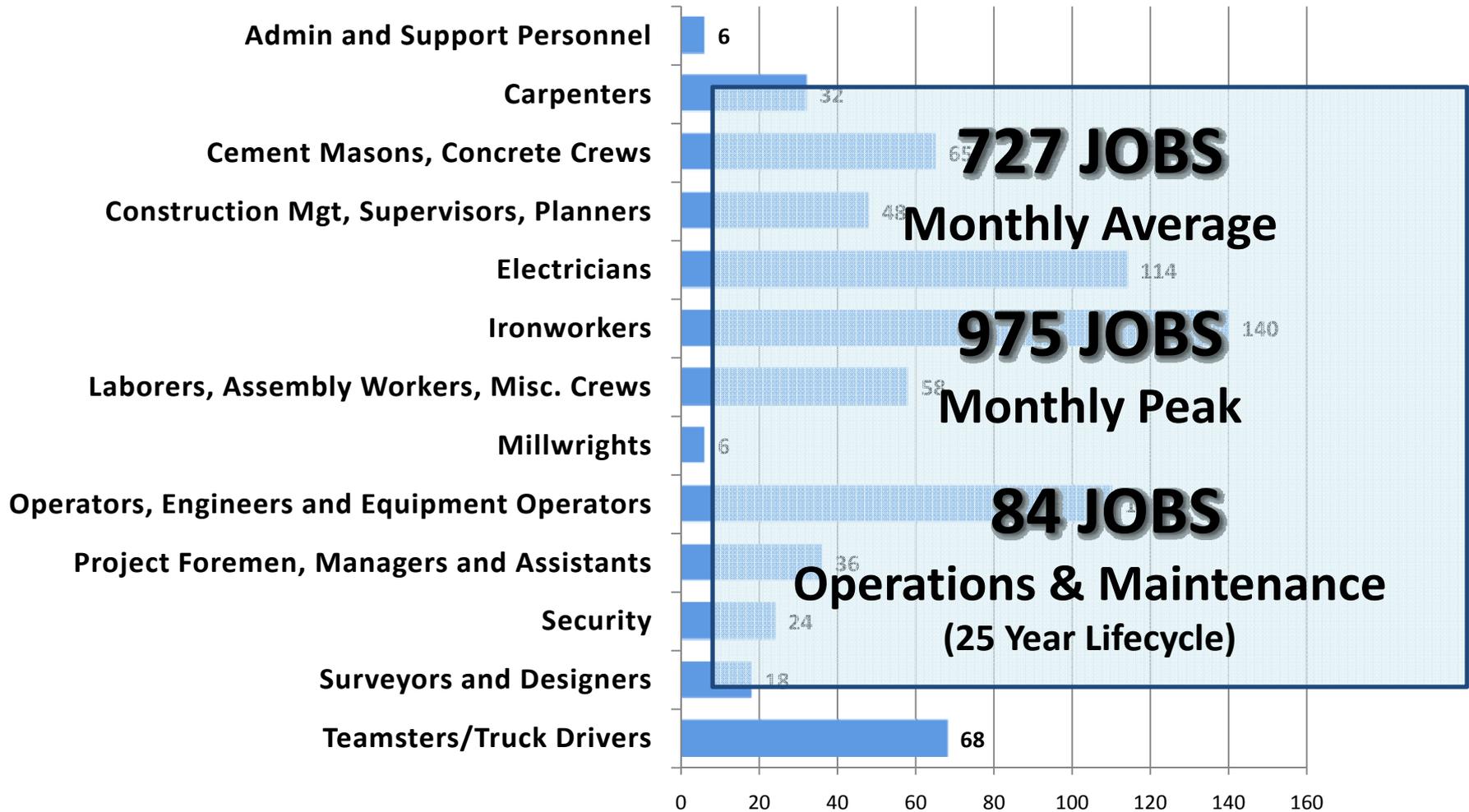




Monthly Construction Jobs Estimates

3 Wind Projects: 1,070 MW

Length of Construction: 1 – 3 Years



Kern County Economic Benefits from the Pacific Wind Project During the Long-Term Operating Phase

Initial Year	Total Revenues to Businesses, Governments, and Households	Value Added Payments to business owners, employees, and property owners	Employment Compensation	Employment (FTE employee-years)	Sales Taxes	Property Taxes
<i>Direct</i>	\$5,025,894	\$4,769,545	\$3,558,409	58		
<i>Indirect</i>	\$178,390	\$93,161	\$37,584	0.6		
<i>Induced</i>	\$3,048,221	\$1,784,189	\$801,075	25		
Initial Year Total	\$8,252,505	\$6,646,895	\$4,397,068	83	\$151,776	\$4,146,695
20-Year Total*	\$165,050,100	\$132,937,900	\$87,941,360	1,660	\$3,035,520	\$82,933,900

*Based on 20-year economic life assumption and initial year operating expenditure estimates.

SOURCE: "The Economic Impacts of the Proposed *Pacific Wind Project* Kern County, CA, October 21, 2010"

DR. ROBERT FOUNTAIN

Professor Emeritus
California State University, Sacramento
Regional Economics Consulting

www.RegionalEconomics.Org



Over 7,700 MW of Solar Projects Prioritized in Southern California



LARGE-SCALE SOLAR CONSTRUCTION WORKFORCE NEEDS

DEVELOPER	TECHNOLOGY	PROJECT NAME	MW SIZE	AVG # JOBS	EMPLOYMENT LENGTH
				FTEs PER MONTH	
ABENGOA	Parabolic Trough	Mojave Solar 1 Project	250	830	2 Years
SOLAR MILLENNIUM	Parabolic Trough	Blythe Solar Power Plant	1,000	604	~6 Years
SOLAR MILLENNIUM	Parabolic Trough	Palen Solar Power Plant	500	566	3.5 Years
SOLAR MILLENNIUM	Parabolic Trough	Ridgecrest Solar Power Plant	250	405	2.5 years
NEXTERA	Parabolic Trough	Beacon Solar Energy Project	250	507	3.5 years
NEXTERA	Parabolic Trough	Genesis Solar Energy Project	250	507	2.5 Years
TESSERA	Stirling Engine	Imperial Valley Solar	709	360	3.5 years
PERMACITY	Photovoltaics	Five 5 MW Systems	25	500	.5 year
SUNPOWER	Photovoltaics	California Valley Solar Ranch	250	353	~3 Years
TOTAL			3,484 MW	4,632 JOBS/MONTH	~3 YEARS

The survey is a sample, not a census, of all the projects being developed. Prepared by Center for Energy Efficiency & Renewable Technologies





**The largest rooftop PV system in the US built in 2010
Mira Loma, California by PermaCity Solar. 3.4 MW PV System.**





**150kW Solar Carport Built in 2011
in El Monte, California. Cathay Bank headquarters.**





11kW Building-Integrated PV in Santa Monica, California. Energy powers common areas in the multi-use residential complex.



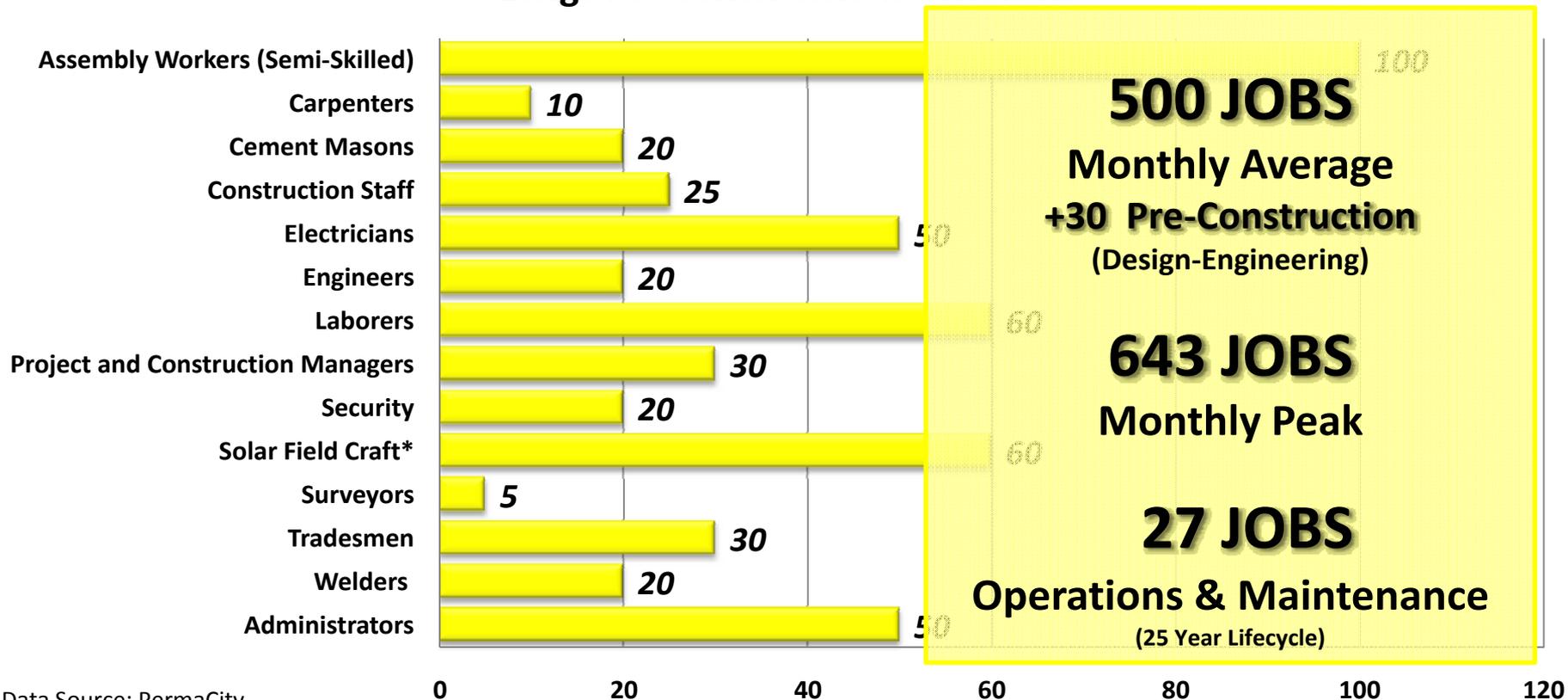
Monthly Construction Jobs Estimates

In Full-Time Equivalent Jobs (FTEs)

10 PV Projects - 30 MW Total

Rooftops/Carports

Length of Construction: 6 Months



*The Solar Field Craft is a CEC job category. These crews may include Foremen, Equipment Operators, Ironworkers, Carpenters, Masons, and Pipefitters and Welders.

Source: PermaCity Solar Response, CEERT Jobs Survey



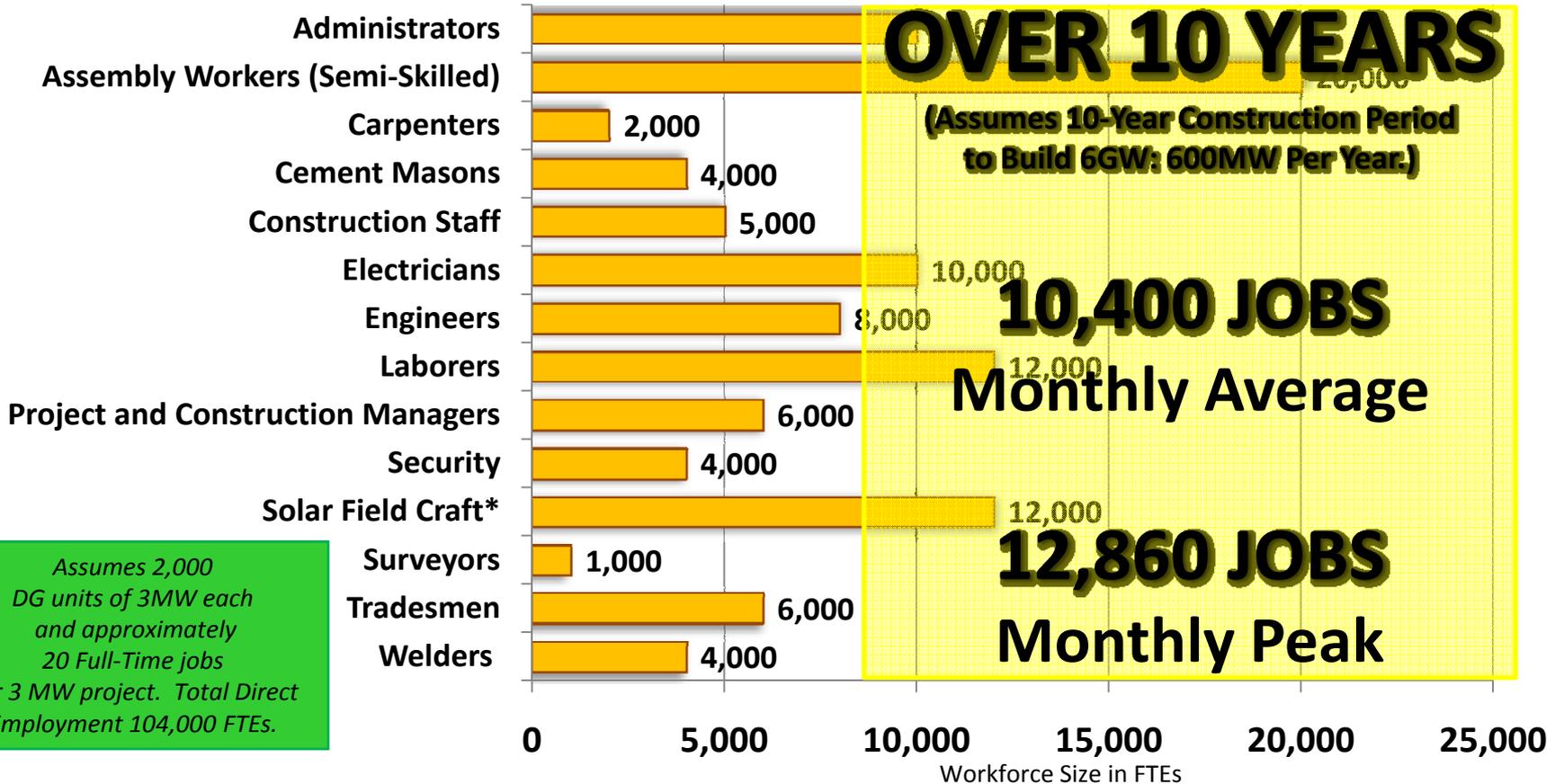
ESTIMATED ANNUAL EMPLOYEE EARNINGS & TAX RECEIPTS OVER 20 YEARS ON 30MW DISTRIBUTED PV GENERATION

CONSTRUCTION-RELATED EARNINGS <i>Year 1</i>	\$ 20.9 Million	
LIFECYCLE O&M EARNINGS <i>\$1.2M Annually Over 20 Years</i>	\$ 24 Million	
ANNUAL INDIVIDUAL INCOME TAXES <i>Paid by Employees</i>	State	\$ 2 Million
	Federal	\$ 7.2 Million
ANNUAL EMPLOYMENT TAXES <i>Paid by Developer/Operator</i>	State (Unemployment, Other)	\$ 600,000
	Federal (SSI, Medicare, Fed. Income Tax)	\$ 4.3 Million
ANNUAL CORPORATE INCOME TAXES <i>Paid by Owner/Operator</i>	State	\$ 180,000
	Federal	\$ 690,000
PROPERTY TAXES <i>Annually Over 20 Years</i>	County, State	\$ 37,500



SUBSTANTIAL DIRECT EMPLOYMENT POTENTIAL

CONSTRUCTION JOBS TO BUILD 2,000 PV PROJECTS (6GW TOTAL DG)



Assumes 2,000 DG units of 3MW each and approximately 20 Full-Time jobs per 3 MW project. Total Direct Employment 104,000 FTEs.



Estimated Payroll Earnings On 6GW of PV Installations

\$4.2 BILLION

Total Construction Payroll

Estimate Based on \$2.1 Million Payroll per 3MW.
($\$2.1 \text{ Million} \times 2,000 \text{ 3MW Systems}$)

\$42 MILLION

Annual Construction Payroll

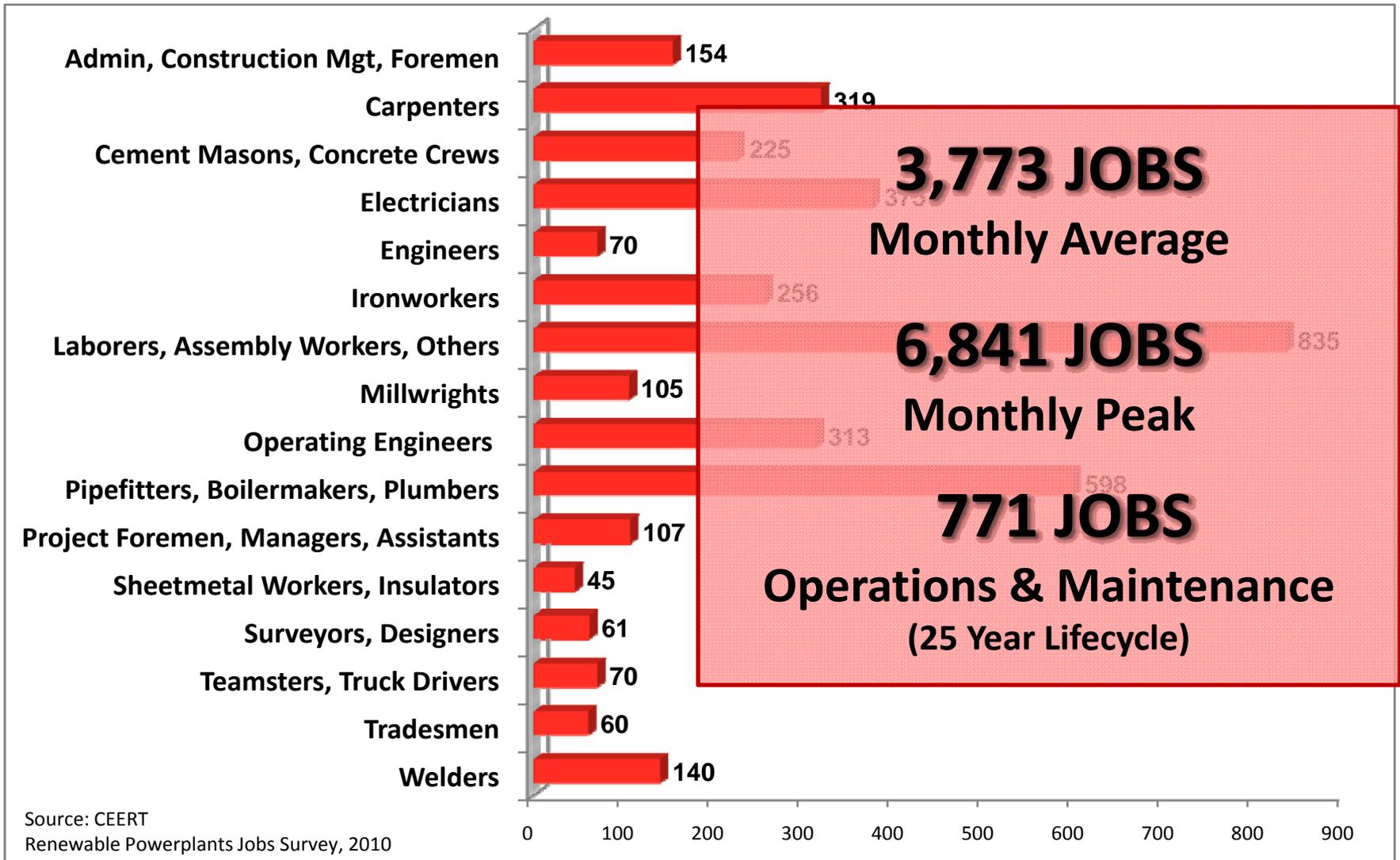
\$240 MILLION
Total O&M Earnings



Monthly Construction Jobs Estimates

7 Solar Thermal Projects: ~3,500 MW

Length of Construction: 2.5 – 6 Years



CONSTRUCTION WORKFORCE ESTIMATES

1,000 MW PARABOLIC TROUGH PLANT

Construction Period: ~6 Years

Job Description	AVERAGE Monthly Workforce (FTEs)	PEAK Monthly Workforce (FTEs)
Administrators and Support Personnel	11	14
Carpenters	57	90
Cement Masons and Concrete Crews	59	95
Construction Management, Supervisors, Planners	2	3
Electricians	58	81
Engineers	7	8
Ironworkers	24	50
Laborers, Assembly Workers, Misc. Crews	106	271
Millwrights	14	18
Operators	57	152
Pipefitters, Boilermakers, Plumbers	136	299
Project Foremen, Managers and Assistants	2	3
Surveyors and Designers	8	20
Teamsters, Truck Drivers	18	43
Other Skilled Tradesmen	12	66
Welders	1	1
Others (Oilers, Security, Sprinklerfitters, Tech Advisors)	5	10
TOTAL	577	1004
Source: SolarMillennium, CEERT Renewable Powerplants Jobs Survey, 2010		



OPERATIONS & MAINTENANCE JOBS EARNINGS 250 MW SOLAR THERMAL POWERPLANT



Job Description	Annual Workforce	Salary (Average)
General: Office Personnel, Administration, Managers	10	\$ 126,500
Engineering: Controls, Electrical, Mechanical, Plant and Resource Engineers, Project Analyst, Chemical Technician, Engineering Technician, Operations Supervisors	6	\$ 117,500
Maintenance: Mechanical Technicians, Electricians, Equipment Operators, Welders, Machinists, Planners, Equipment Washing Technicians, Auto Mechanics	25	\$ 87,800
Operations: Shift Supervisor, Control Operator, Plant Operator, etc.	22	\$ 91,100
Unskilled Labor	5	\$ 25,000
TOTAL	68	\$ 92,600

CONSTRUCTION WORKFORCE NEEDS 250 MW PHOTOVOLTAIC SYSTEM

Construction Period Length: ~3 Years

Job Description Average	AVERAGE Monthly Workforce (FTEs)	PEAK Monthly Workforce (FTEs)
Administrators	2	4
Carpenters	12	15
Cement Masons	10	20
Construction Staff	3	6
Electricians	25	50
Engineers	2	2
Laborers	10	20
Operating Engineers	7	15
Operators	5	10
Project and Construction Managers	7	10
Solar Field Craft: Incl's Apprentices, Assistants and Helpers	90	133
Surveyors	4	8
Teamsters	20	30
Welders	15	30
TOTAL	212	353

Source: CEERT Renewable Powerplants Jobs Survey, 2010, SunPower



UNEMPLOYMENT RATES HIGH IN CLEAN ENERGY PROJECT COUNTIES

Imperial	31.30%
Kern	14.40%
Los Angeles	12.50%
Riverside	15.30%
San Bernardino	14.80%
San Luis Obispo	9.70%
<small>Source: July 2010 Statistics CA EDD, Labor Market Information Division</small>	



COUNTY SNAPSHOTS

July 2009-July 2010

Construction Job Losses 2009-2010

Utility, Transportation Job Losses 2009-2010

Construction/Utility Jobs Gains From 14 Projects In CEERT Survey

IMPERIAL

Jobs lost:  **200**

09-10 Change: **-14.3%**

Jobs lost:  **400**

09-10 change: **-3.9%**

773 Jobs

3 - 4 Years

1 Stirling
2 Geo
962 MW

KERN

Jobs lost:  **1,600**

09-10 change: **-12.6%**

Jobs lost:  **100**

09-10 change: **-0.2%**

2014 Jobs

1 - 4 Years

3 Wind
2 Solar
1970 MW

LOS ANGELES

Jobs lost:  **13,400**

09-10 change: **-11.7%**

Jobs lost:  **7,300**

09-10 change: **-1%**

200 Jobs

0.5 Year

5 Solar
30 MW

RIVERSIDE SAN BERNARDINO

Jobs lost:  **10,000**

09-10 change: **-14.7%**

Jobs lost:  **3,300**

09-10 change: **-1.2%**

2,528 Jobs

3.5 - 6 Years

4 Solar
2000 MW

SAN LUIS OBISPO

Jobs lost:  **700**

09-10 change: **-13.7%**

Jobs lost:  **500**

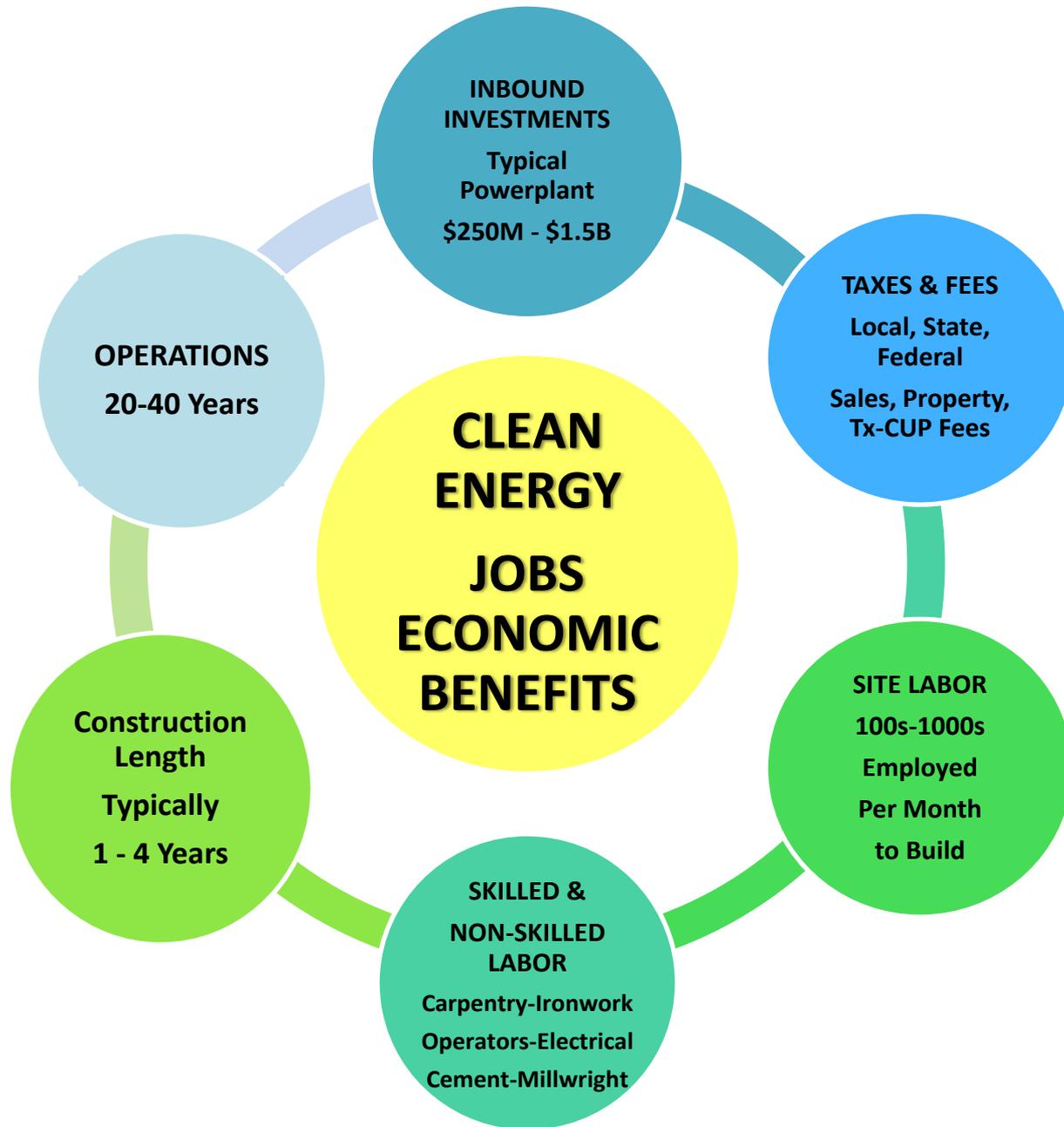
09-10 change: **-2.7%**

212 Jobs

3.5 Years

1 Solar
250 MW







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www.ceert.org

