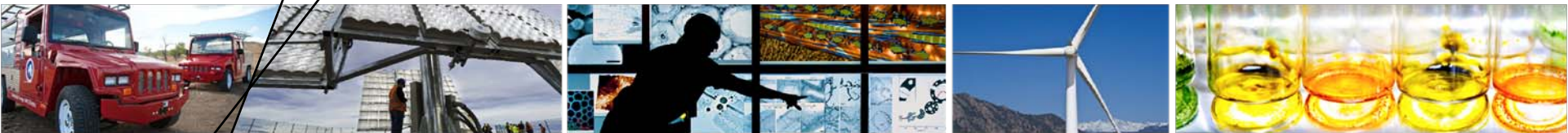


# National Renewable Energy Laboratory: Activities Related to Jobs Impacts



**California Energy Commission  
IEPR Lead Commissioner Workshop  
Jobs and Renewable Energy in California**

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**DOCKET**

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# NREL Jobs Activities Highlights

- **Jobs Analysis Tools**
- **Jobs Analyses**
- **Workforce Development Data and Analysis**
- **Manufacturing Cost Analysis**



# The Jobs And Economic Development Impacts (JEDI) Model Suite

**Energy Analysis**

## JEDI *Jobs and Economic Development Impact Models*

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◀ JEDI Home

**About JEDI**

- Biofuels Models
- Coal Model
- CSP Model
- Natural Gas Model
- Photovoltaics Model
- Wind Model
- Marine & Hydrokinetic Power Model

**Download JEDI**

**Methodology**

**Interpreting Results**

**Advanced Users**

**Limitations of JEDI Models**

**Publications**

**Help**

### About JEDI Models

The Jobs and Economic Development Impact (JEDI) model estimates the economic impacts of constructing and operating a renewable energy project at the local (usually state) level. JEDI results are in terms of jobs, earnings, and output.

Based on user-entered project-specific data or defaults, the model estimates the number of jobs and economic impacts to a local area, such as a fuel production facility, or other project. For example, the model can estimate the impacts from a new wind farm.

Jobs, earnings, and output are distributed across the following categories:

- Project Development and Onsite Labor Impacts
- Local Revenue and Supply Chain Impacts
- Induced Impacts

JEDI model defaults are based on interviews with industry experts. Data contained within the model are derived from Minnesota and national data files.

### Who uses JEDI?

- Input-output methodology
- Three types of estimates: Onsite, supply chain, and induced
- Scope: State impacts for a project
- Users: county and state decision-makers, public utility commissions, potential project owners, developers
- Data sources: IMPLAN, industry research for defaults, user input

[http://www.nrel.gov/analysis/jedi/about\\_jedi.html](http://www.nrel.gov/analysis/jedi/about_jedi.html)

# JEDI Model Availability

- **Current public JEDI models**
  - Utility-scale wind
  - Natural gas (combined cycle)
  - Coal (IGCC)
  - Marine and hydrokinetic
  - Concentrating solar power
  - Ethanol (dry mill corn and cellulosic)
  - Photovoltaic (four scales)
- **JEDI models under development**
  - Hydropower (conventional, small)
  - Offshore wind
  - Small wind
  - Transmission
  - Geothermal
  - Biopower
  - Petroleum

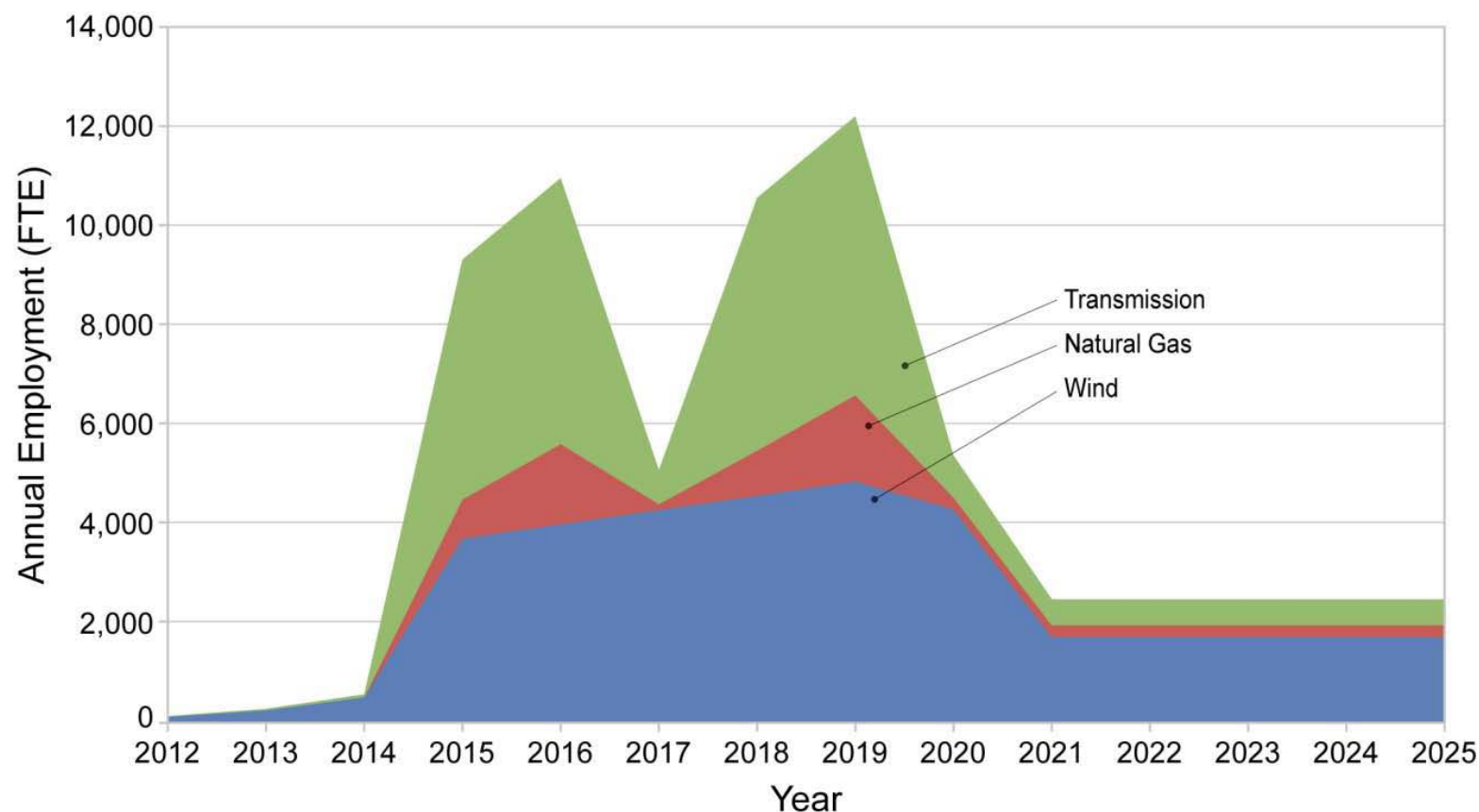


Photo from Sally Wright, Renewable Energy Research Lab - Umass, NREL/PIX15160

- **Energy Input-Output Calculator (IOCalc)**
  - Forecasts jobs, earnings, output for 2010-2035
  - Several electric sector technologies in one tool
  - Allows differing assumptions about manufacturing costs over the next 25 years
- **PV Project JEDI** (beta testing at <https://jedi.nrel.gov/>)
  - New web-based version to replace spreadsheet-based version of JEDI for PV
- **PV Scenario JEDI**
  - Models state or regional-level jobs and economic impacts over a multi-year target period for an entire policy or market size.
  - Offers links to useful resources on solar projections by state from SEIA/GTM; solar carve-out capacity by state, map of manufacturing facilities, etc.

# Wyoming Economic Development Proposal

JEDI results show total employment projections in Wyoming from new infrastructure development in power sector



Lantz, E. (2011). [Economic Development from Gigawatt-Scale Wind Deployment in Wyoming \(Presentation\)](#). NREL (National Renewable Energy Laboratory). 21 pp.; NREL Report No. PR-6A20-51572.

# Treasury Grant 1603 Program Impacts

## Summary Estimates of the Direct and Indirect Jobs, Earnings, and Output Supported

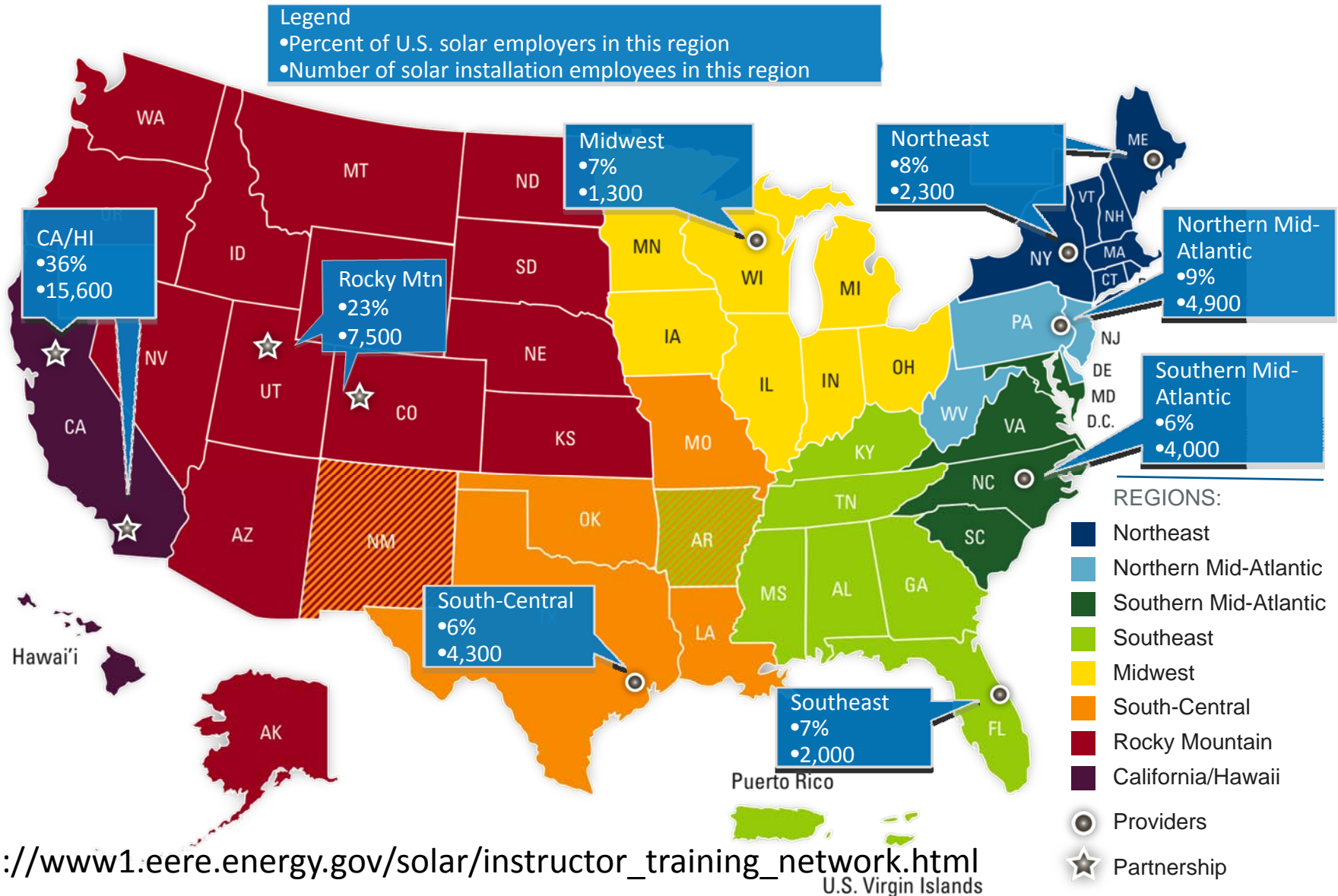
	Average Jobs per year (FTE/year)	Total Earnings (Billions \$)	Total Economic Output (Billions \$)
<b>During Construction Period (2009-2011)</b>			
Large Wind	44,000-66,000	\$7.7-\$12.0	\$23.0-\$39.0
Photovoltaic	8,300-9,700	\$1.5-\$1.8	\$3.5-\$4.7
Total Direct + Indirect	52,000-75,000	\$9.2-\$14.0	\$26.0-\$44.0
<b>During Operational Period (annual for system lifetime)</b>			
Large Wind	4,500-4,900	\$0.26-\$0.29	\$1.60-\$1.70
Photovoltaic	610-630	\$0.04	\$0.09
Total Direct + Indirect	5,100-5,500	\$0.3-\$0.3	\$1.7-\$1.8

Steinberg, D.; Porro, G.; Goldberg, M. [\(2012\). Preliminary Analysis of the Jobs and Economic Impacts of Renewable Energy Projects Supported by the Section 1603 Treasury Grant Program](#). 33 pp.; NREL Report No. TP-6A20-52739.



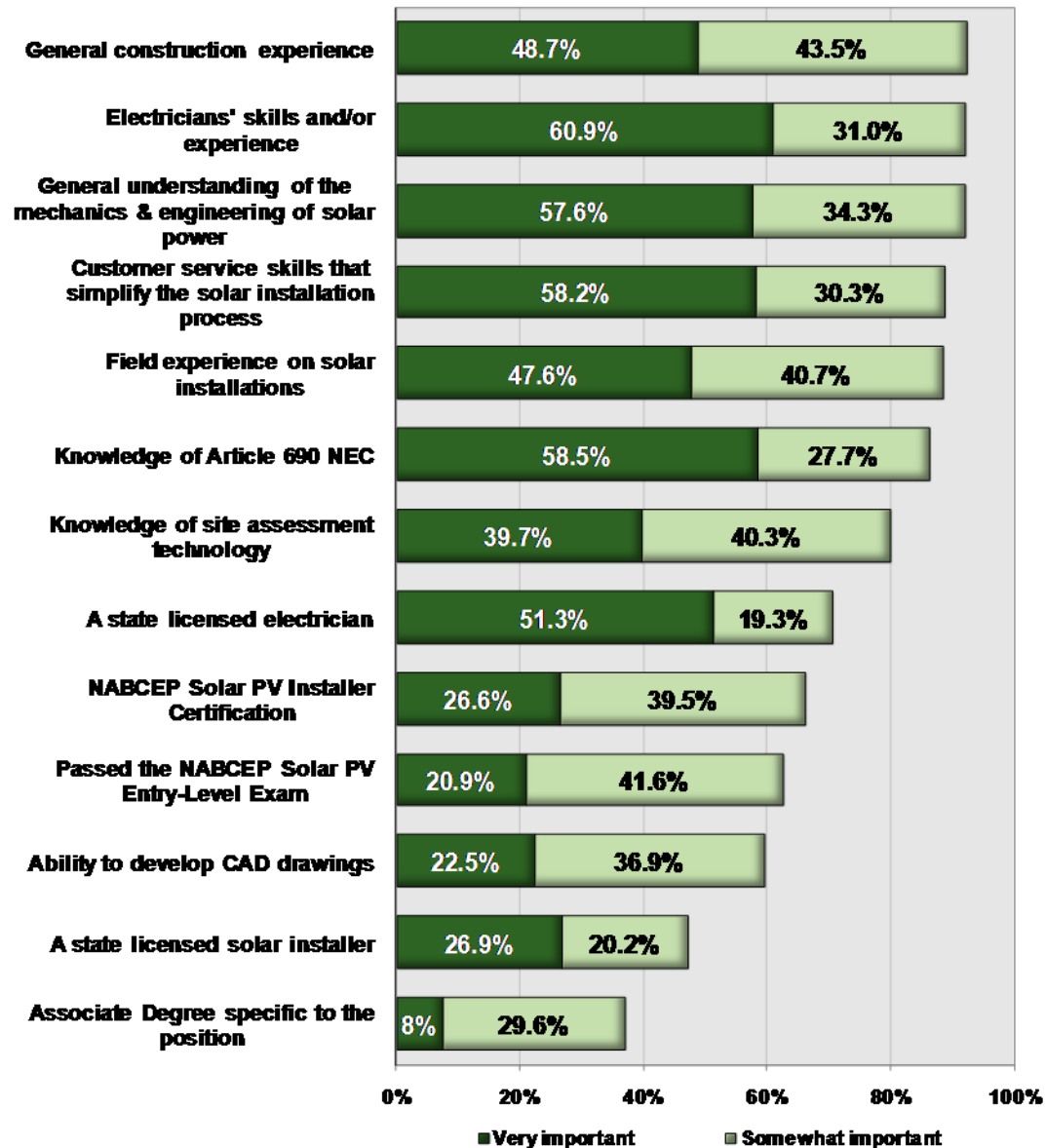
# Solar Instructor Training Network

With 2010 Labor Market Analysis Survey Data of Solar Installers





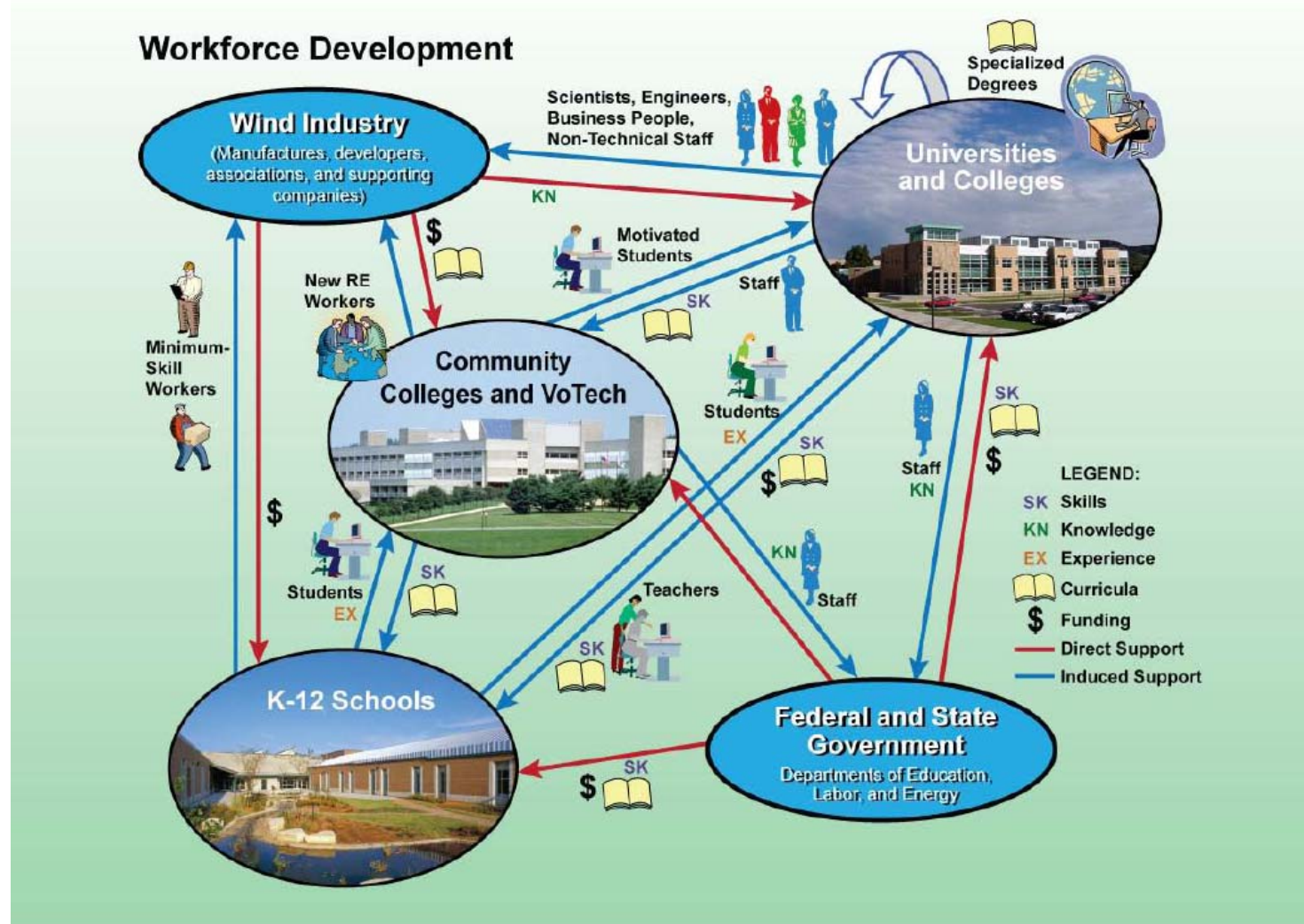
# Solar Labor Market Analysis



What is important to solar installers for hiring employees?

Source: Friedman, Jordan, Carrese. (December 2011), "Solar Installation Labor Market Analysis," TR NREL/TP-6A20-49339, <http://www.nrel.gov/docs/fy12osti/49339.pdf>.

# Wind Workforce Roadmap and Analysis



Baring-Gould, I. (2011). [Wind Energy Workforce Development: A Roadmap to a Wind Energy Educational Infrastructure \(Presentation\)](#). NREL (National Renewable Energy Laboratory). 16 pp.; NREL Report No. PR-7A20-51599.

# Solar Jobs and Mfg Costs in China and U.S.

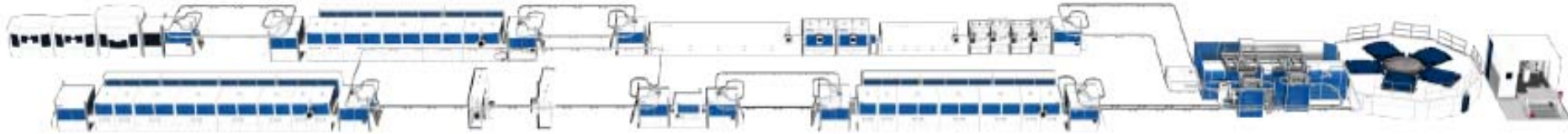


Illustration of a silicon cell line from the SCHMID Group | Gebr. SCHMID GmbH

- **Direct labor content varies from <1.0 job/MWP DC to 4.0 jobs/MWP DC**
  - Suntech automation strategy (~1.4 jobs/MWP DC) reflects inflation risk, not cost benefits
- **Relative to low cost labor regions, automation requires:**
  - 80% less direct labor content, 33% additional investment (automation)

500 MW <sub>pDC</sub> c-Si Cell & Module Facility	US			China		
	Cells	Modules	Total	Cells	Modules	Total
No. of Direct Laborers (all shifts)	296	104	400	1492	508	2,000
Unskilled Labor rate (\$ per hour)	\$13.33			\$2.13		
Manufacturing Engineer (\$ per year)	\$75,110			\$8,171		
Total facility Capex (\$/W <sub>p</sub> )	\$0.49	\$0.19	\$0.68	\$0.35	\$0.16	\$0.51

Goodrich, A.; James, T.; Woodhouse, M. (2011). [Solar PV Manufacturing Cost Analysis: U.S. Competitiveness in a Global Industry \(Presentation\)](#). NREL (National Renewable Energy Laboratory). 45 pp.; NREL Report No. PR-6A20-53938.

# Thank you!



PIX 19051

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