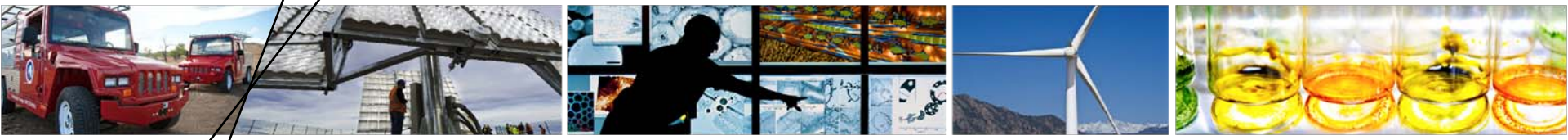
NREL
NATIONAL RENEWABLE ENERGY LABORATORY

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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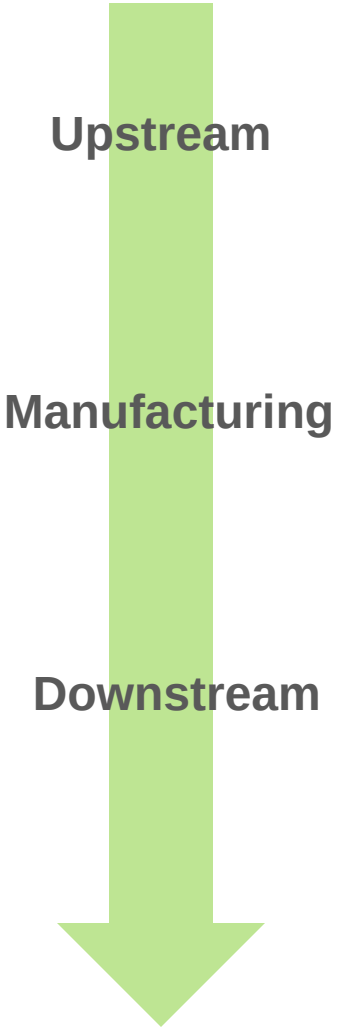
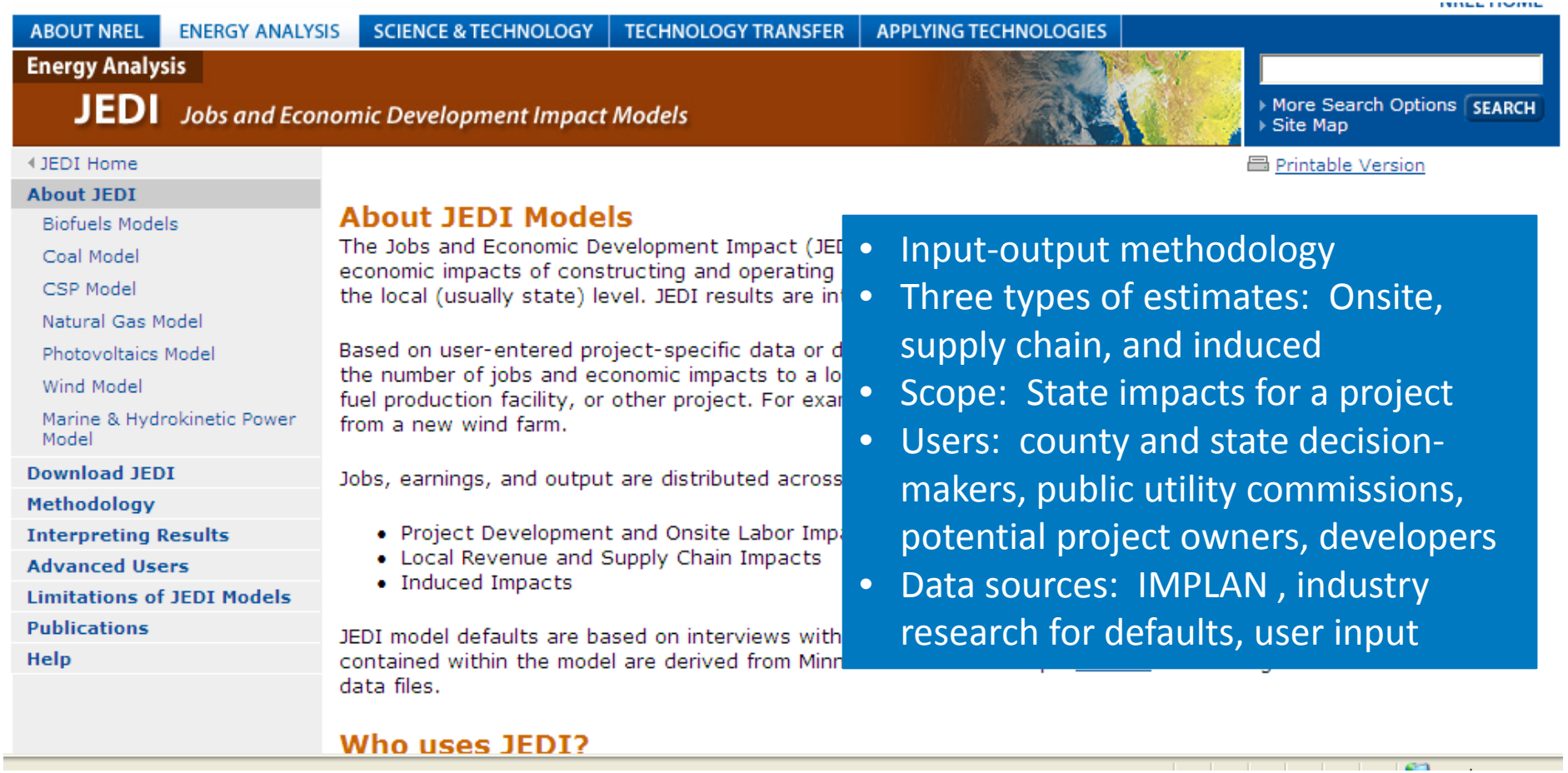
NREL Jobs Activities Highlights

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



The Jobs And Economic Development Impacts (JEDI) Model Suite



- 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

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

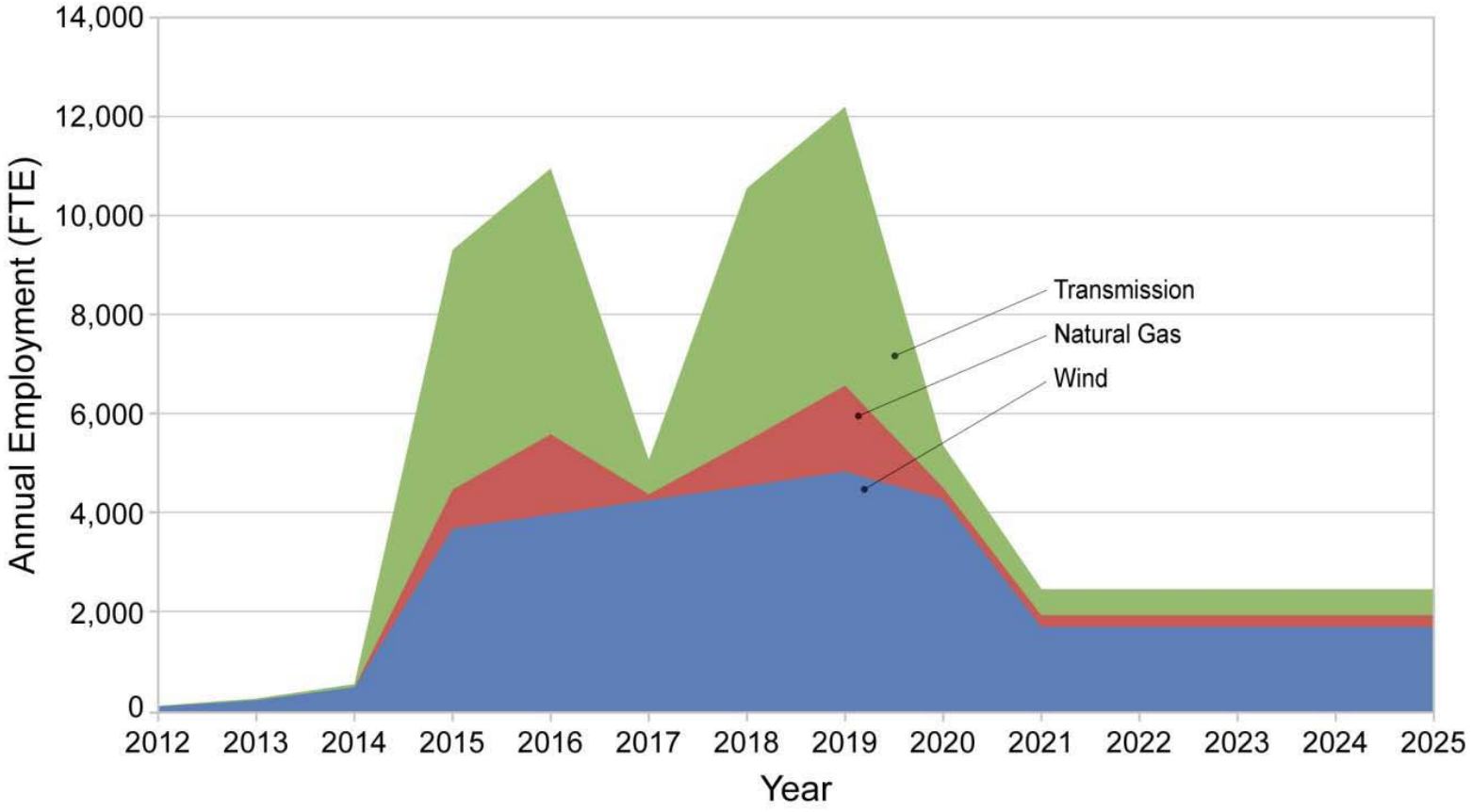
Photo from Sally Wright, Renewable Energy Research Lab - Umass, NREL/PIX15160

New Jobs Analysis Tools in Process

- **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.

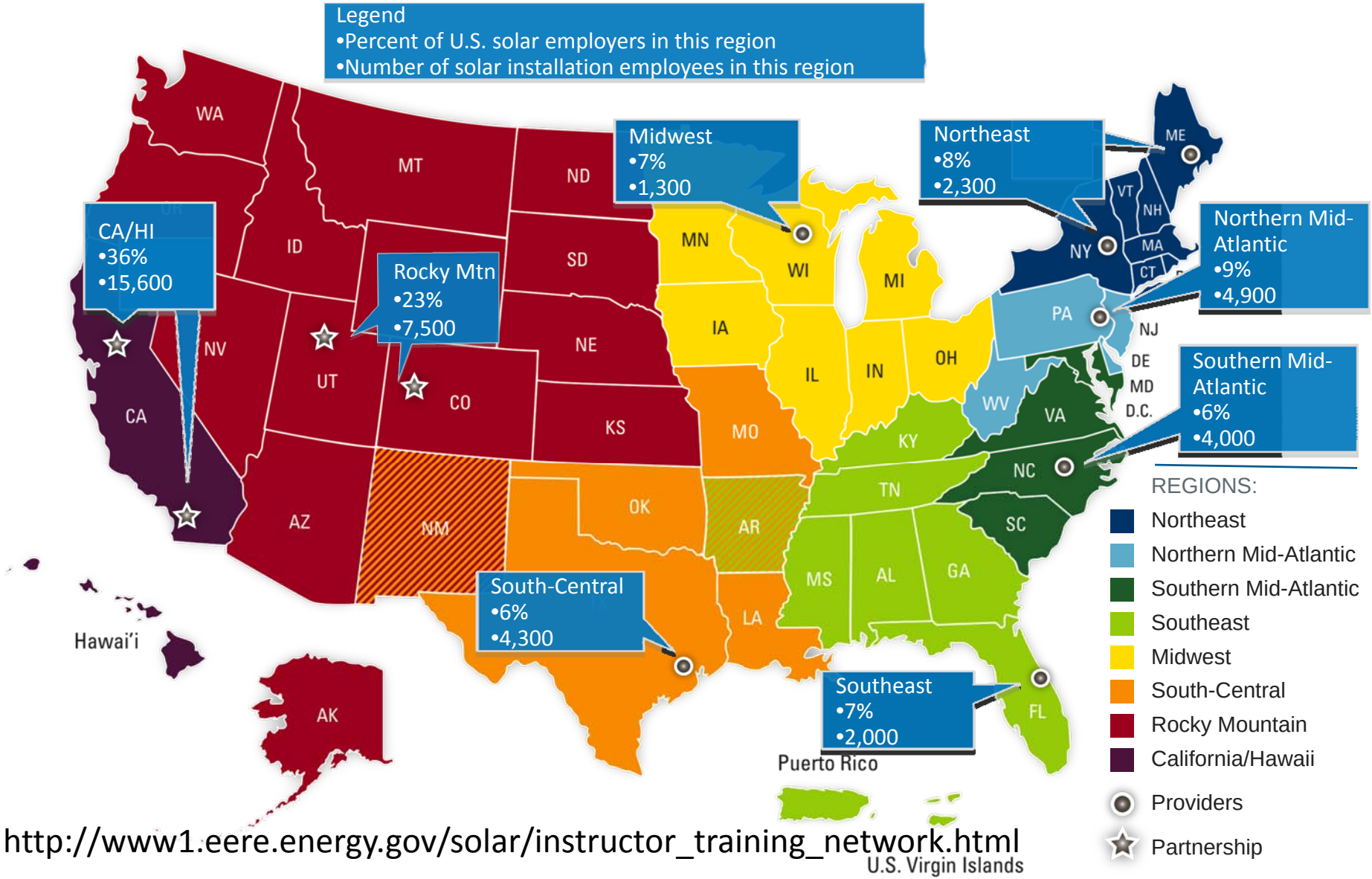
Treasury Grant 1603 Program Impacts

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 $)
During Construction Period (2009-2011)			
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
During Operational Period (annual for system lifetime)			
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.

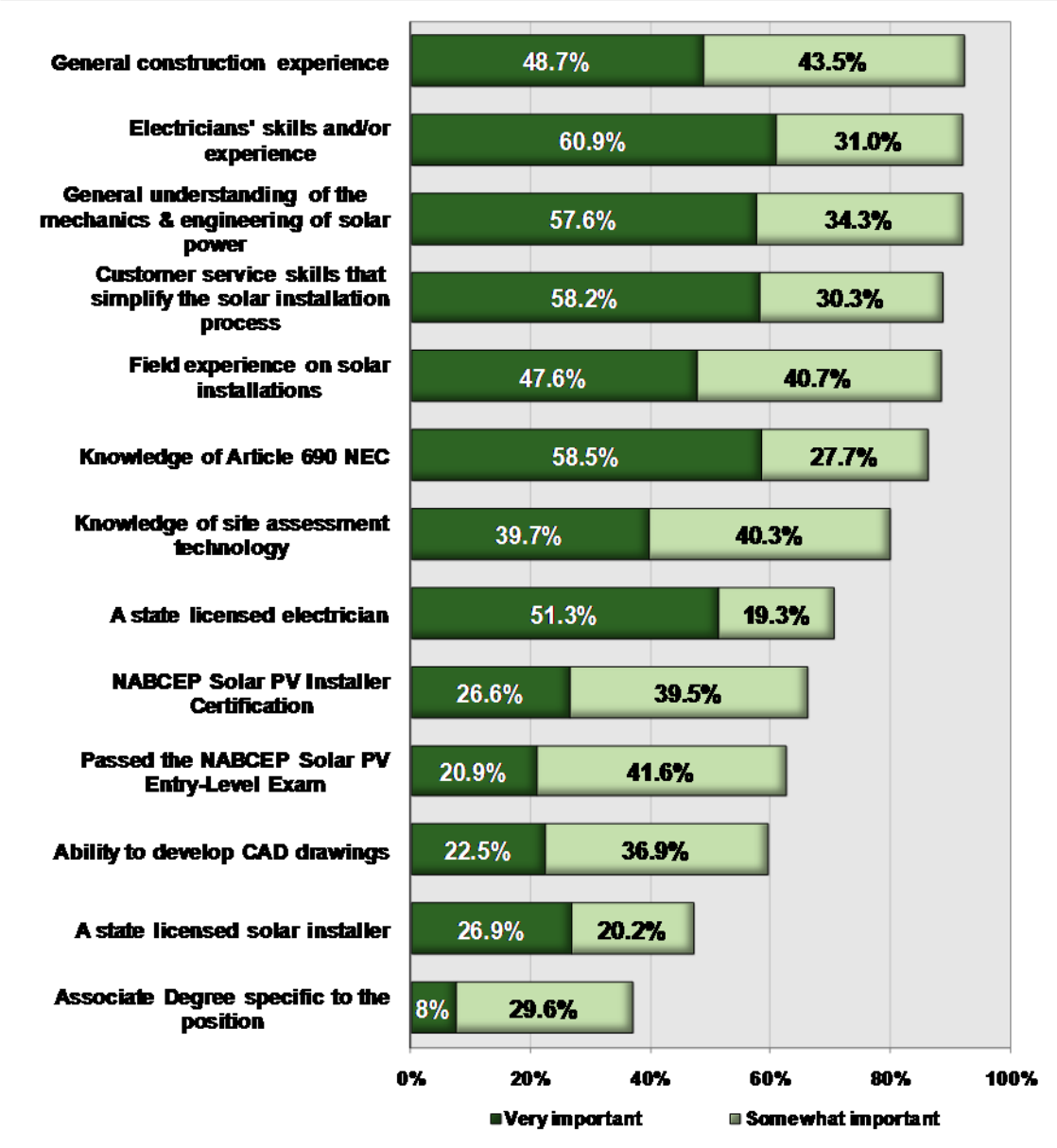
Solar Instructor Training Network

With 2010 Labor Market Analysis Survey Data of Solar Installers



http://www1.eere.energy.gov/solar/instructor_training_network.html

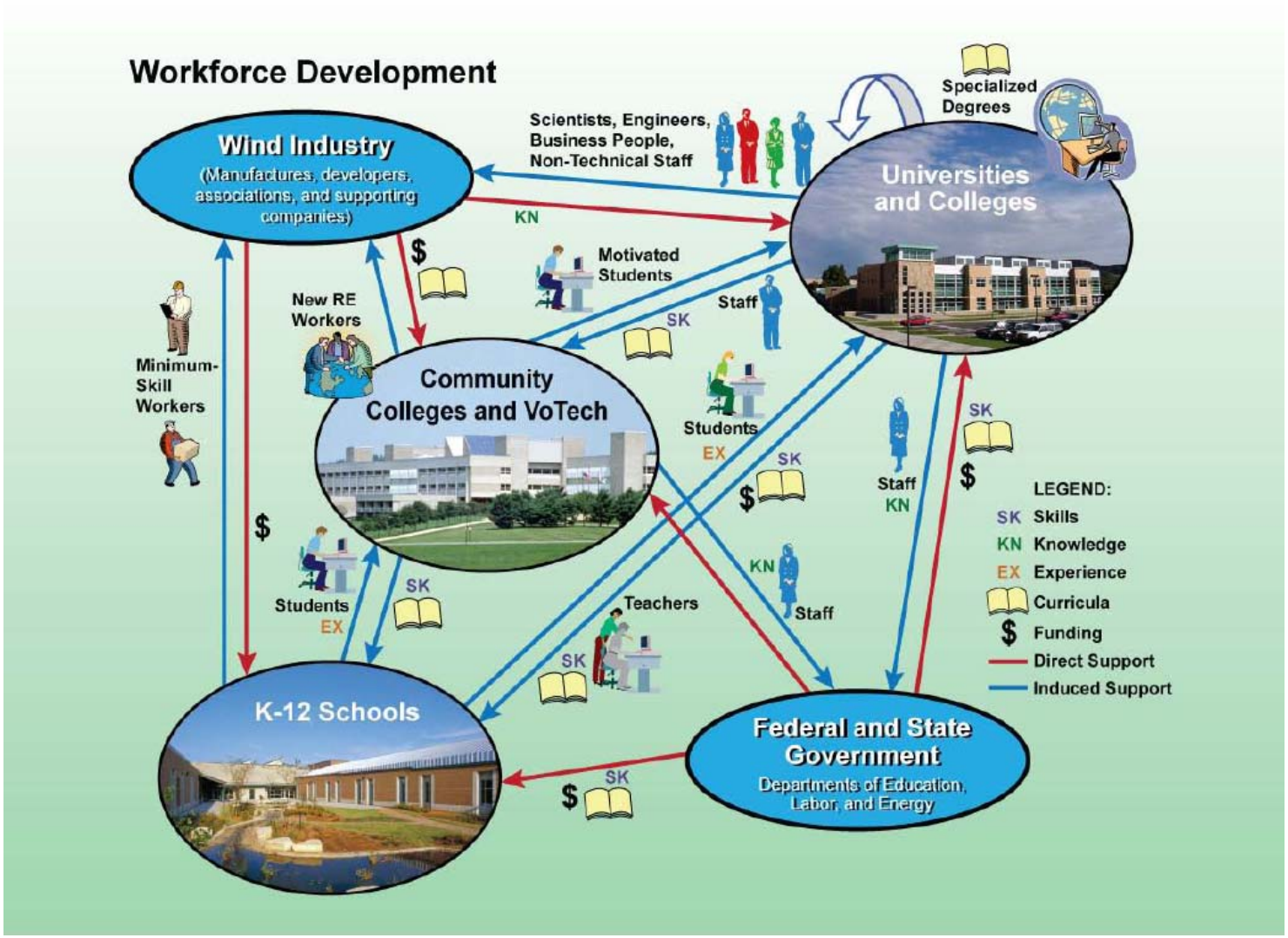
Solar Labor Market Analysis



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.

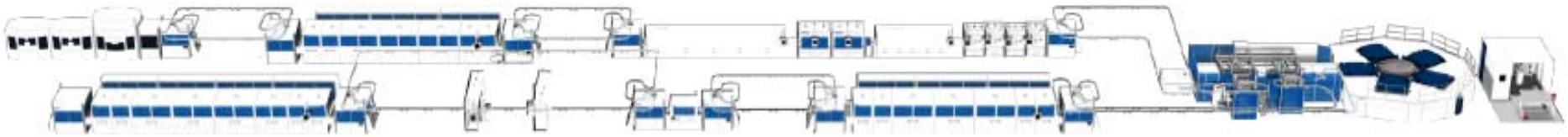


Illustration of a silicon cell line from the SCHMID Group | Gebr. SCHMID GmbH

- **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 $MW_{P\,DC}$ 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			$8,171		
Total facility Capex ($/$W_p$)	$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!

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