



# ***Expanding PV Training Capability to Meet Growing Workforce Needs***

## **Workforce Training – National Perspectives and Best Practices Session**

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Raleigh, North Carolina  
February 3, 2009





## ***U.S. PV Market: Number of Grid-Tied Installations per Year***

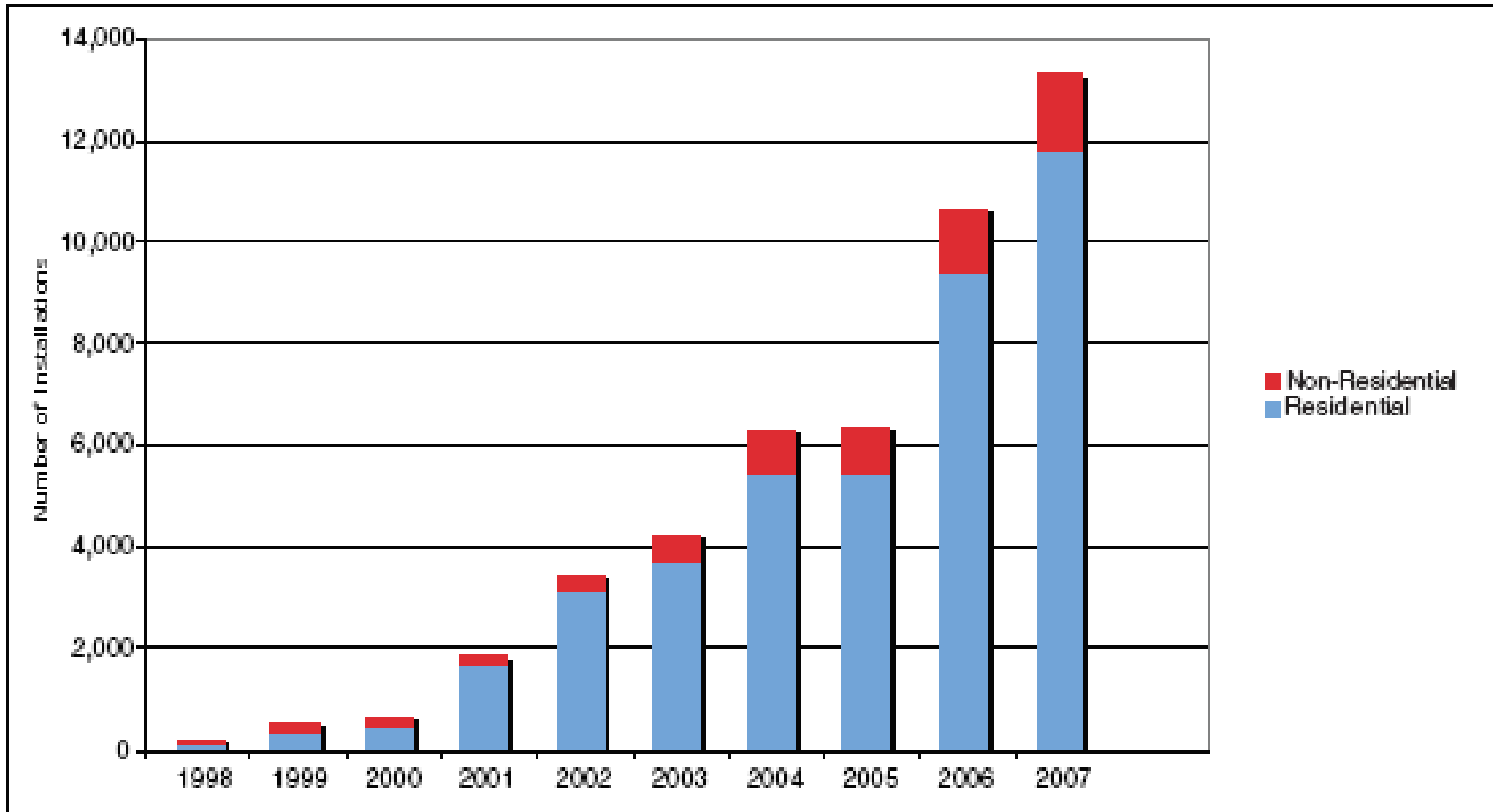


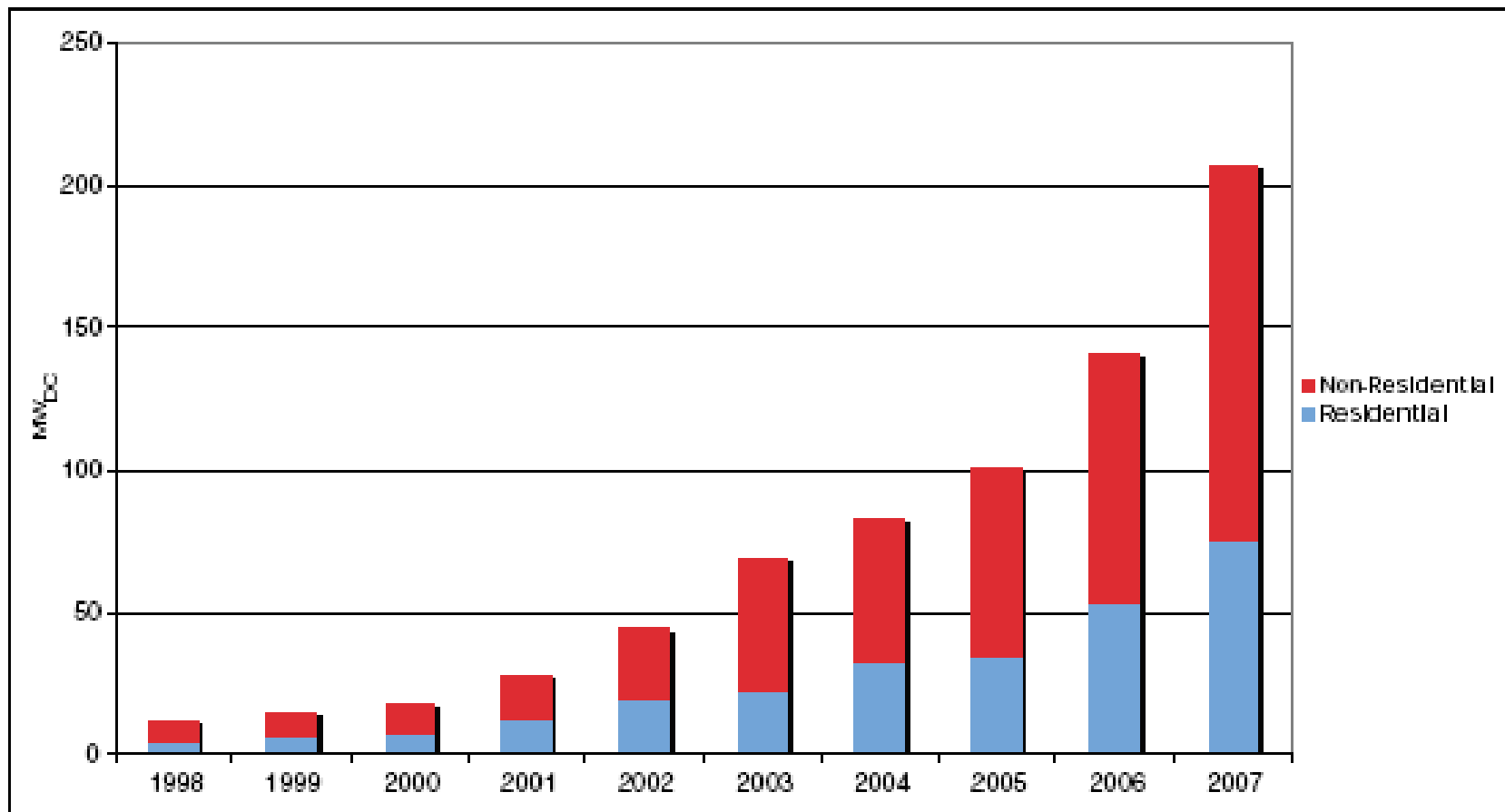
Fig. 6: Number of Annual Grid-Connected Photovoltaic Installations (1998-2007)

Source: L Sherwood, IREC



# ***U.S. PV Market: Installed Capacity in DC Megawatts***

Fig. 2: Annual Installed Photovoltaic Capacity by Sector (1998-2007)

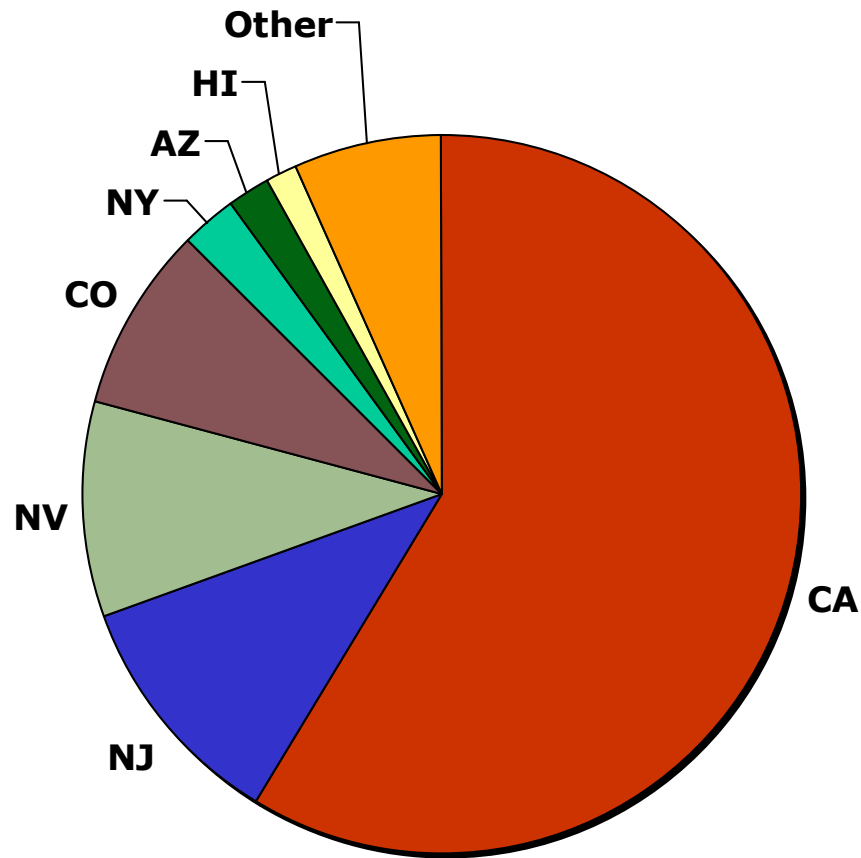


Source: L Sherwood, IREC



# *2007 Grid-Tied PV Installations by State*

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# *Market Summary*

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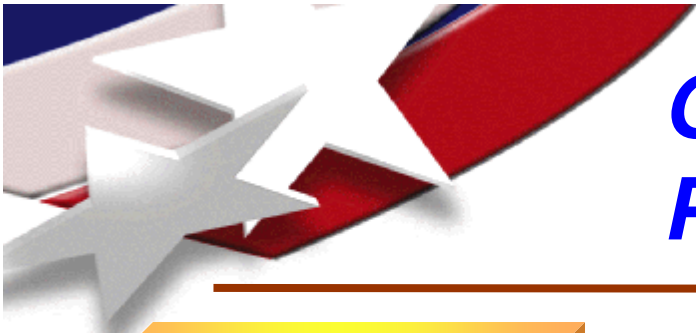
- ◆ PV markets have been expanding exponentially.
- ◆ Grid-tied PV installations are growing the most rapidly:
  - More installations
  - Larger installations
  - More states involved
- ◆ Navigant Consulting Study:
  - A 30-fold increase in installed capacity is projected by 2016
  - 440,000 total jobs, including 110,000 direct jobs in solar
- ◆ Florida Strategic Plan:
  - 51,000 direct jobs in solar over the next 20 years
  - \$12.6 billion in revenue
- ◆ Growth is concentrated in states with the most progressive policies.
- ◆ This rapid growth will place a heavy burden on workforce development and training.



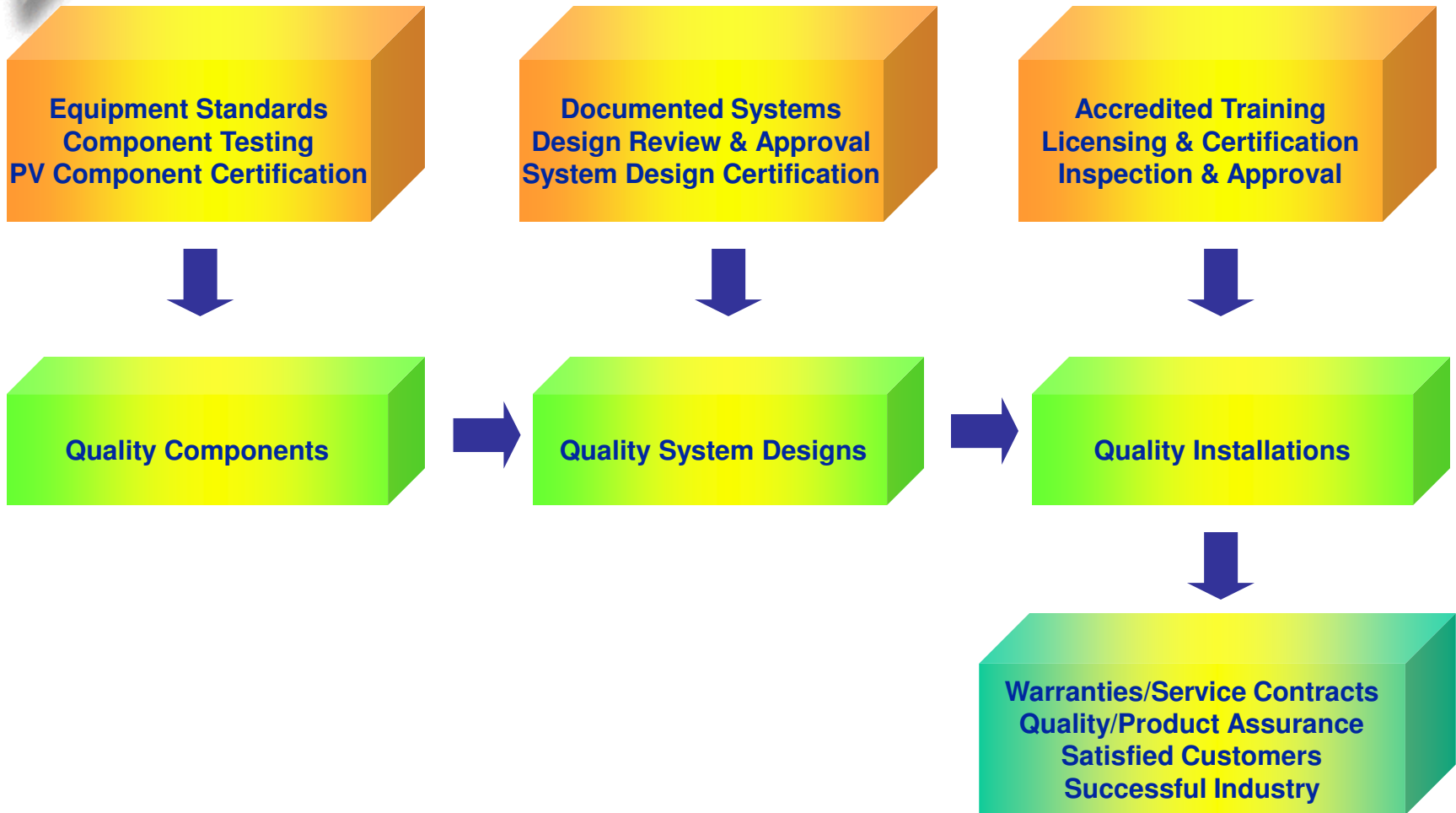
## ***Training Needs and Challenges***

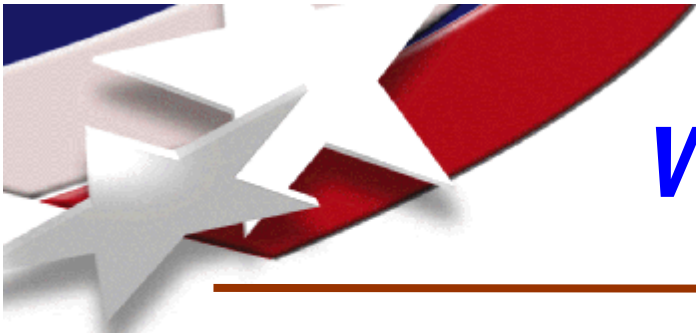
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- Local and accessible training
- Curriculum development, including both content and instructional systems design
- Well-equipped labs for hands-on instruction
- On-the-job training and internship opportunities for students
- High quality training consistent with task-aligned objectives



# Quality Assurance for Photovoltaic Power Systems





## ***Who needs to be trained?***

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1. PV installers
2. PV designers and engineers
3. Licensed contractors
4. Building code officials
5. Sales and site assessment personnel
6. Architects and building designers
7. Utility personnel
8. Construction cost accountants

Source: Based on IREC surveys primarily in California, Florida and New York.



## ***Renewable Energy Training: Best Practices & Recommended Guidelines***

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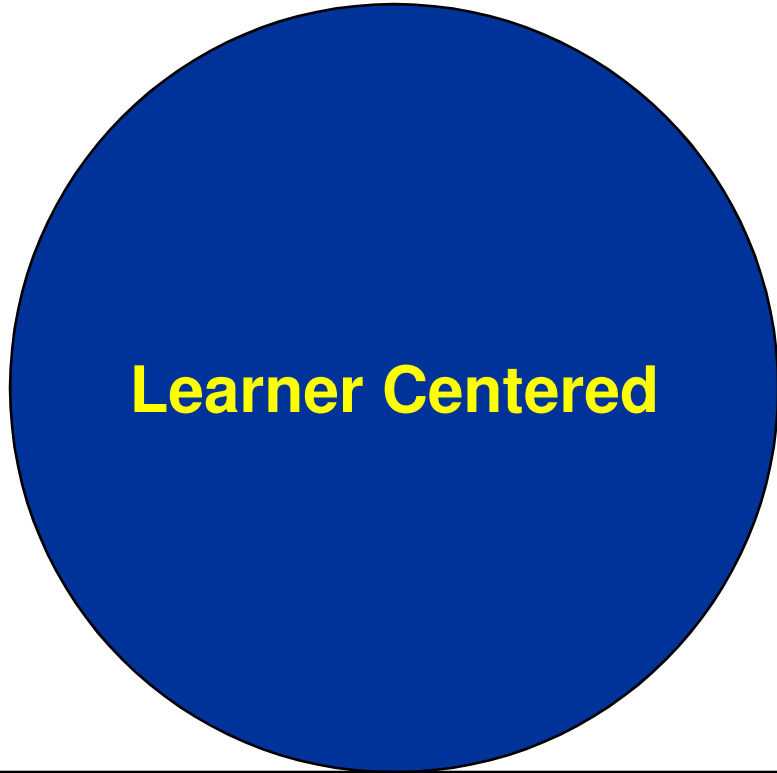
- Section 1 – Guidelines for Training
- Section 2 – The Task (Job) Analysis
- Section 3 – Types of Educational Programs
- Section 4 – Essential Steps of Designing a Training Course
- Section 5 – A Checklist for Assessing Learning Outcomes
- Section 6 – Certification & Accreditation
- Section 7 – Equipment Recommendations for Training
- Section 8 – Resources & Text Books

***Document available at [www.irecusa.org](http://www.irecusa.org)***



# ***Guiding Principle for Training***

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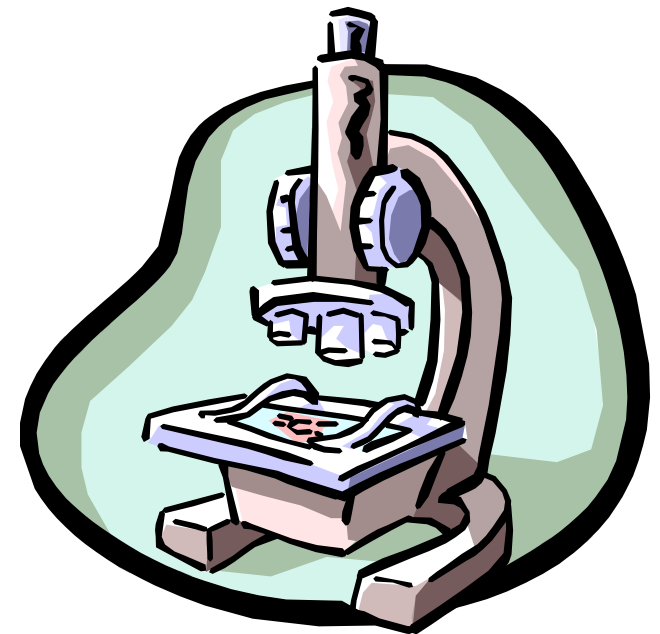




## ***The Task (or Job) Analysis***

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The process of analyzing a job by breaking it down into main and subordinate tasks, prioritizing the tasks, and showing the relationships among them.





# ***NABCEP's PV Installer Task Analysis***

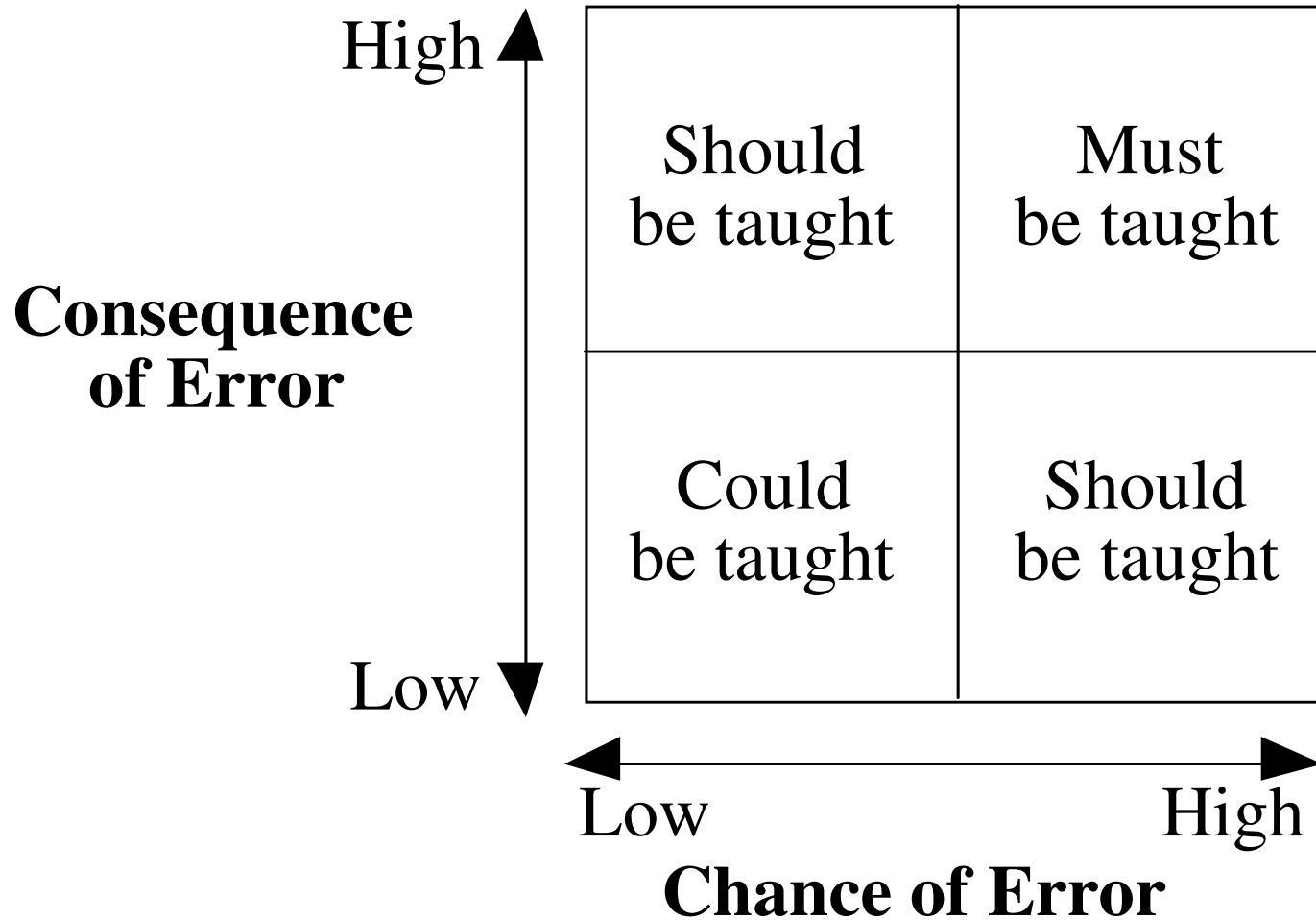
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Purpose is to define a standard set of competencies required of contractors who install grid-connected PV systems.

1. Working safely with PV systems
2. Conducting a site assessment
3. Selecting a system design
4. Adapting the mechanical design to the site
5. Adapting the electrical design to the site
6. Installing subsystems and components at the site
7. Performing a system checkout and inspection
8. Maintaining and troubleshooting a system



## *Rating the Importance of Tasks*





# ***PV Train-the-Trainer Workshops***

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## ◆ **California**

- Pleasant Hill (near Oakland): September 18-19, 2008
- San Diego: January 20-21, 2009
- Santa Monica: January 22-23, 2009
- Planned: Sacramento, San Jose, Fresno; Dates TBD

## ◆ **Florida**

- Cocoa; May 19-22, 2008 and June 16-19, 2008
- Planned: Workshops for all Florida community colleges and vocational-technical institutes in 2009

## ◆ **New York**

- Troy: June 5-6, 2008
- Planned: Two Workshops, Dates and Locations TBD



# *Faculty Backgrounds vs. Type of Workshop*

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## *Faculty Background*

- ◆ Have taught in the construction trades, but are new to PV
- ◆ Knowledgeable of PV but new to teaching PV
- ◆ Have taught in related areas, but not PV or in the construction trades

## *Type of Workshop*

- ◆ 4 to 5-day programs (PV training + content materials + ISD)
- ◆ 2-day programs (ISD + content materials)
- ◆ (3 to 5-day programs (PV training + content materials + ISD)

ISD = Instructional Systems Design



# ***PV Systems Course Development Workshops***

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Shortcutting the course development process:

- ◆ Course goals and terminal objectives ✓
- ◆ Task analyses and list of skills/competencies ✓
- ◆ Specific course objectives and test items need to be developed
- ◆ Sample course outline for PV installers course ✓
- ◆ Descriptions of successful programs ✓
- ◆ Text and resource guide with teaching materials ✓
- ◆ Suggested facilities, hardware and equipment ✓



# ***Photovoltaic Systems Text & Resource Guide***

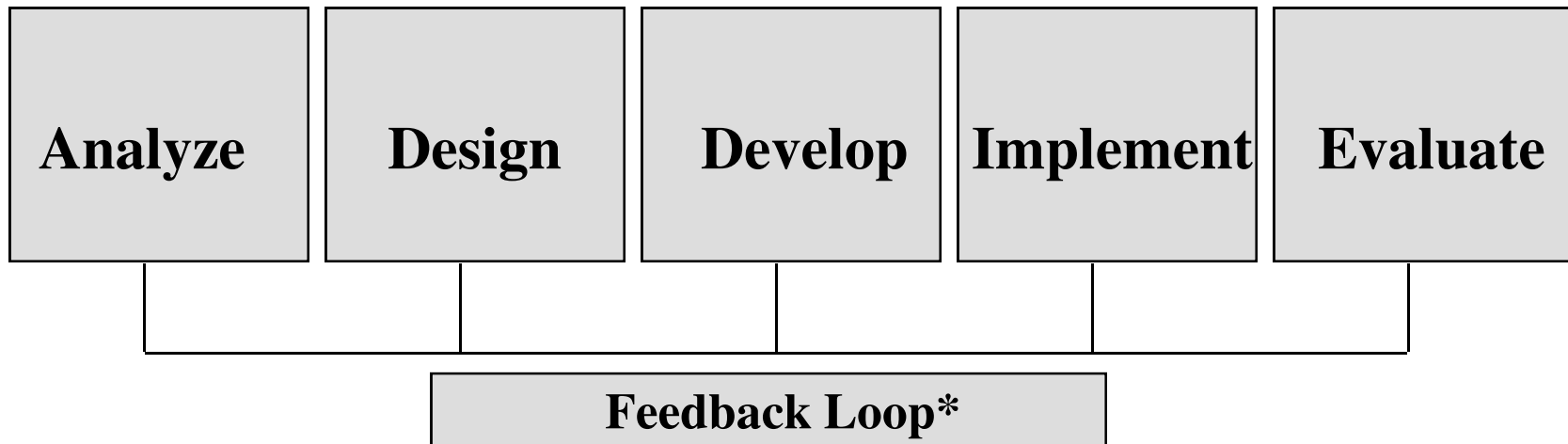
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- ◆ Textbook and three CD-ROMs, instructor's guide and list of competency skills for each chapter
- ◆ Usable PowerPoint slides for all fifteen chapters of the text, along with notes explaining each slide
- ◆ Electronic images of all numbered illustrations in the text
- ◆ Pre-test and post-test questions with answer keys
- ◆ Test development software
- ◆ Solar radiation data sets, sun path charts and solar time calculator
- ◆ Video clips, including a large PV system installation
- ◆ Illustrated glossary and reference material



# *The ADDIE Model: An Instructional System*

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\*It's a system



# ***Certification and Accreditation***

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## **ISPQ ~ Training and Trainer Quality**

- ◆ Accredits training programs and CED course providers
- ◆ Certifies instructors and master trainers
- ◆ ISPQ approval requires a comprehensive audit and compliance to a standard
- ◆ ISPQ does not test

## **NABCEP ~ Practitioner and Student Competence**

- ◆ Tests and certifies PV and solar thermal installers
- ◆ Tests entry level students for achievement
- ◆ NABCEP approval requires successfully passing a test
- ◆ NABCEP does not accredit training or certify trainers



## ***ISPQ Accredited Programs***

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Florida Solar Energy Center  
Solar Energy International  
Midwest Renewable Energy Association  
SUNY Farmingdale  
North Carolina Solar Center  
SUNY Delhi  
Sun Pirate  
Lane Community College  
Great Lakes Renewable Energy Association  
Bronx Community College  
Hudson Valley Community College



## **2009 CONFERENCE**

### **New Ideas in Educating a Workforce in Renewable Energy and Energy Efficiency**

**Nov. 18-20**



Most current information on  
Instructional Strategies  
Curricula Development  
Best practices and models for training

2 days of conference sessions  
1 day of technical workshops

Albany, New York



# *Thank You!*

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