## Global and National Solar Market Outlook



## Solar Energy Uses & Solar Technologies



#### Solar Energy Uses

#### Thermal energy – Passive Solar

- Heat water for use in homes, buildings, or swimming pools
- Heat spaces inside homes, greenhouses, and other buildings

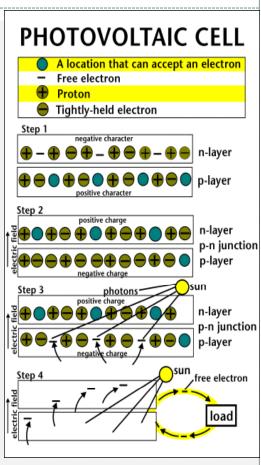
#### Electricity – Active Solar

- Photovoltaic (PV devices) or "solar cells" change sunlight directly into electricity. Individual PV cells are grouped into panels and arrays of panels for use in calculator and watch batteries or systems that power single homes and large power plants.
- Concentrating solar power (CSP) technologies consist of two general categories:
  - **▼ Concentrating Solar Thermal (CST)** power plants generate electricity by using the heat from solar thermal collectors to heat a fluid which produces steam that is used to power the generator. (The U.S. has 11 concentrating solar power generating units, 9 of these are in California, 1 in Arizona, and 1 in Nevada.)
  - Concentrating Photovoltaic (CPV) technologies concentrate the sun's energy directly onto high efficiency PV materials to directly create electricity.



#### **History of the Photovoltaic Cell**

- The first practical photovoltaic (PV) cell was developed in 1954 by Bell Telephone researchers.
- Beginning in the late 1950s, PV cells were used to power U.S. space satellites.
- PV cells were next widely used for small consumer electronics like calculators and watches and to provide electricity in remote or "off-grid" locations.
- Technology advances and government financial incentives have helped to greatly expand PV use since the mid-1990s.
- Shipments of PV cells and panels by U.S. manufacturers in 2006 was the equivalent of about 337 Megawatts, about 25 times greater than the shipments of about 13 Megawatts in 1989.



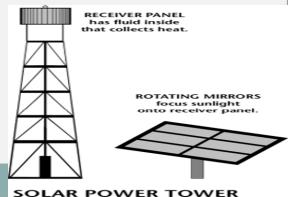


#### **Types of Solar Thermal Power Plant**

- 1. Parabolic troughs collector has a long parabolic-shaped reflector that focuses the sun's rays on a receiver pipe located at the focus of the parabola. The collector tilts with the sun as the sun moves from east to west during the day to ensure that the sun is continuously focused on the receiver.
- 2. **Solar dish**/engine system uses concentrating solar collectors that track the sun, so they always point straight at the sun and concentrate the solar energy at the focal point of the dish.



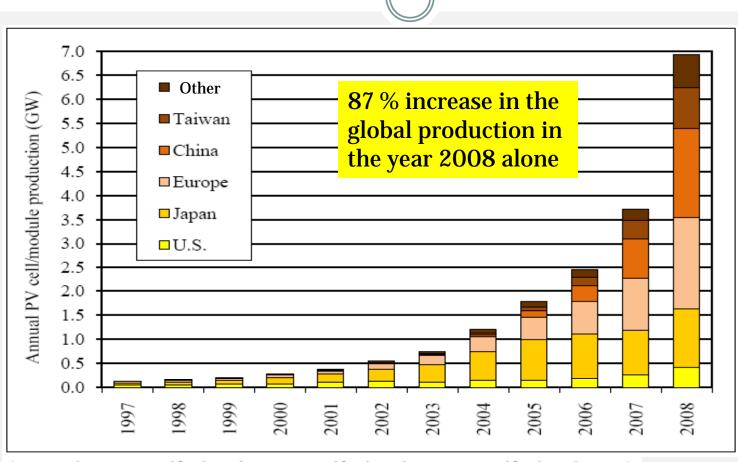
**3. Solar power tower** or central receiver generates electricity from sunlight by focusing concentrated solar energy on a tower-mounted heat exchanger (receiver).



## Global Solar Market Outlook



## Global Annual PV Cell/Module Production by Region



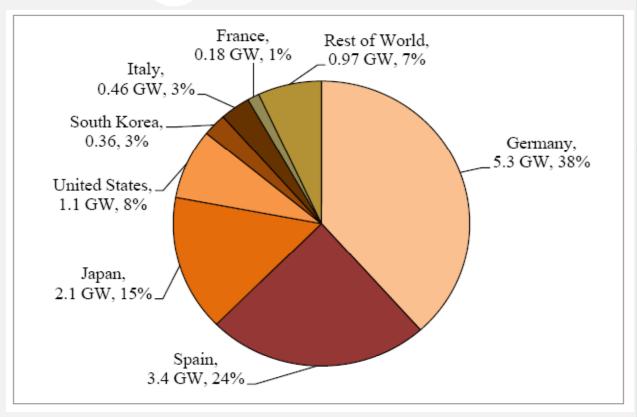
(Maycock 2002, Bradford et al. 2006, Bradford et al. 2008a, Bradford et al. 2009) Florida



## Global Cumulative Installed PV Capacity through 2008 (in gigawatt)

#### **Global Ranking:**

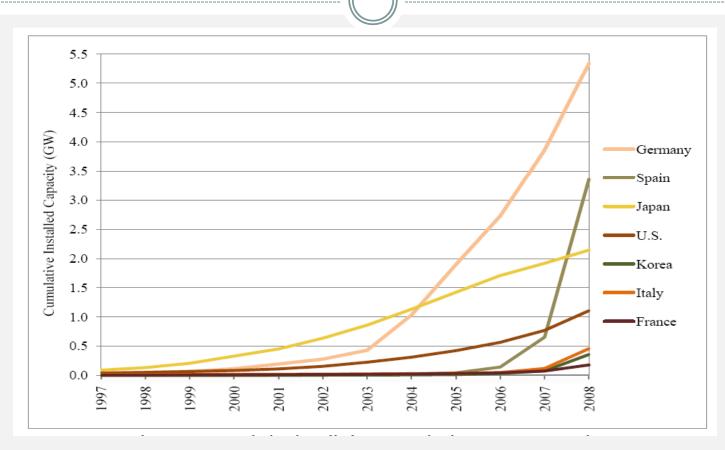
- 1. Germany (38%)
- 2. Spain (24%)
- 3. Japan (15%)
- 4. U.S. (8%)
- 5. Italy (3%)
- 6. South Korea (3%)
- 7. France (1%)



Source: 2008 Solar Technologies Market Report, January 2010.



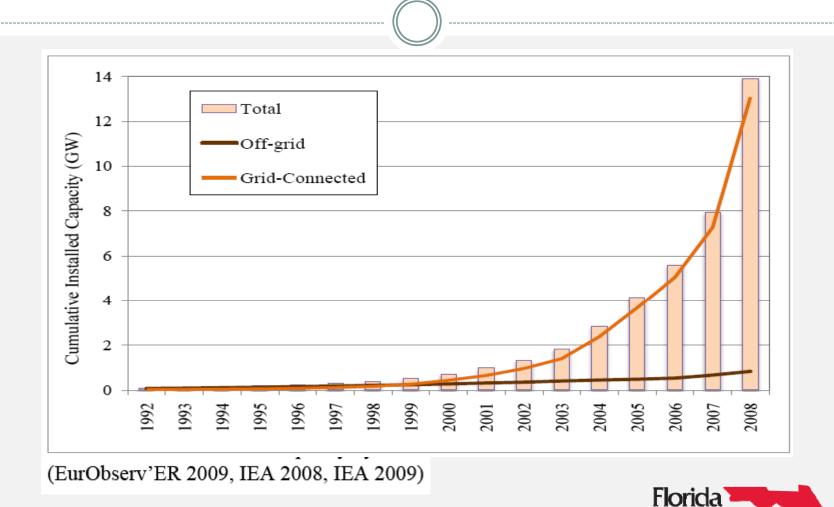
## Cumulative Installed PV Capacity in Top Seven Countries (1997-2008)



Source: 2008 Solar Technologies Market Report, January 2010.



## Cumulative Global Installed PV Capacity by Interconnection Status (1992-2008)



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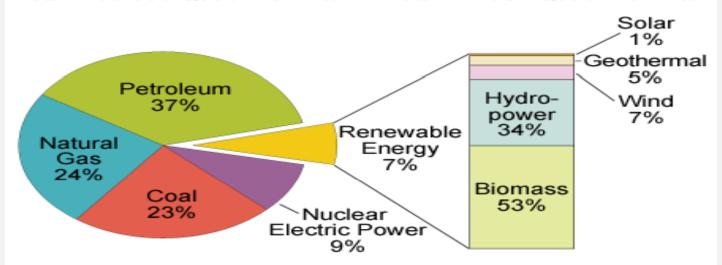
# U.S. Solar Market Outlook



### The Share of Solar Energy in the U.S. Energy Supply

#### Renewable Energy Plays a Role in the Nation's Energy Supply, 2008

Total = 99.305 Quadrillion Btu Total = 7.301 Quadrillion Btu

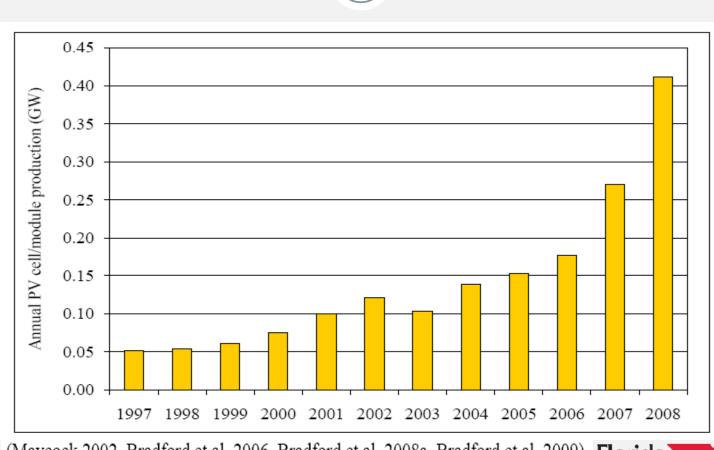


Note: Sum of components may not equal 100% due to independent rounding.

Source: EIA, Renewable Energy Consumption and Electricity 2008 Statistics, Table 1: U.S. Energy Consumption by Energy Source, 2004-2008 (July 2009).



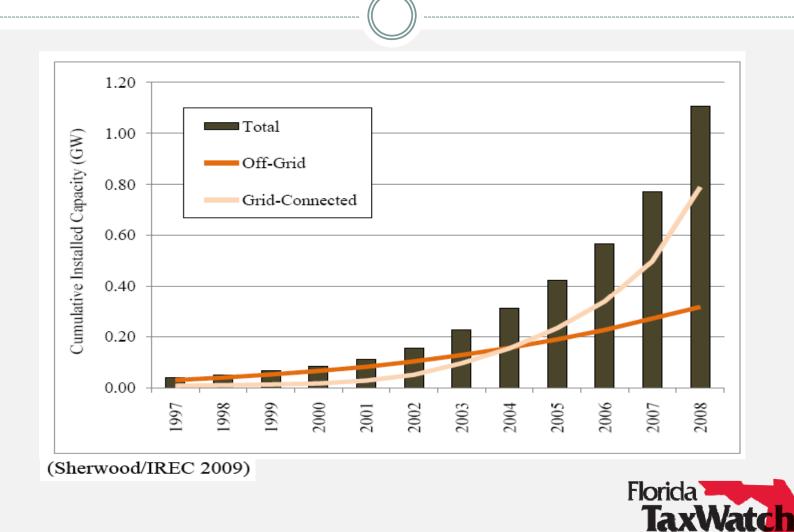
#### U.S. Annual PV Cell/Module Production



(Maycock 2002, Bradford et al. 2006, Bradford et al. 2008a, Bradford et al. 2009) Florica



## U.S. Cumulative Installed PV Capacity by Interconnection Status



## Florida Solar Market Outlook



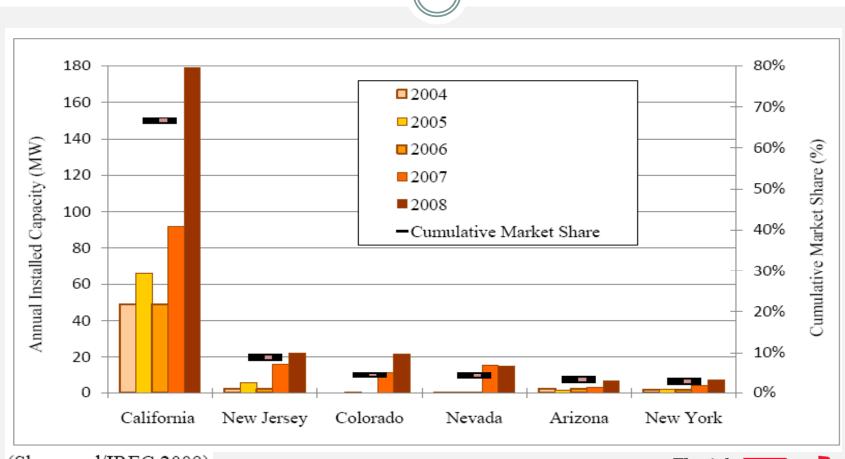
#### The Current State of Florida Solar Market

- Florida currently ranks 11th in the country for solar market attractiveness according to a research conducted through the National Renewable Energy Laboratory (NREL) using a number of factors including energy policies, amount and quality of solar resources, utility rates and customer load match.
- Florida currently does not have any CPS plant.
- Florida has over 250,000 installations of solar water heating systems, saving consumers more than \$30 million in energy costs annually (Source: http://www.floridaenergy.ufl.edu/).



#### **PV Market Shares for the Top Six States**

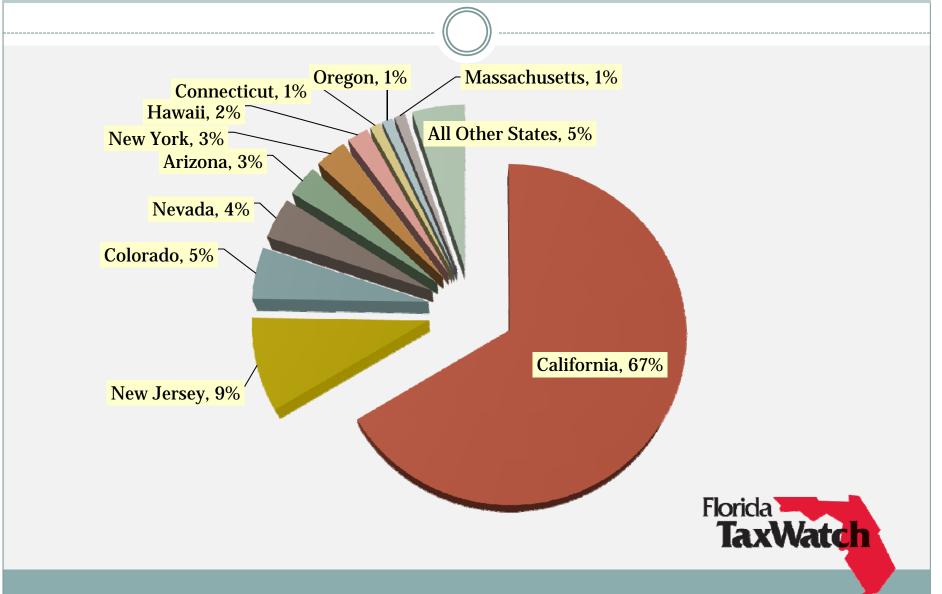
(2004-2008)



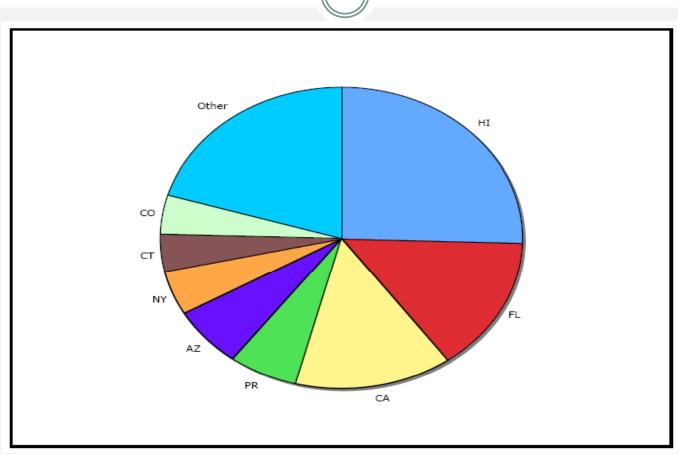
(Sherwood/IREC 2009)



#### Market Share of Top Ten States by Grid Connected PV Capacity Installed Through 2008



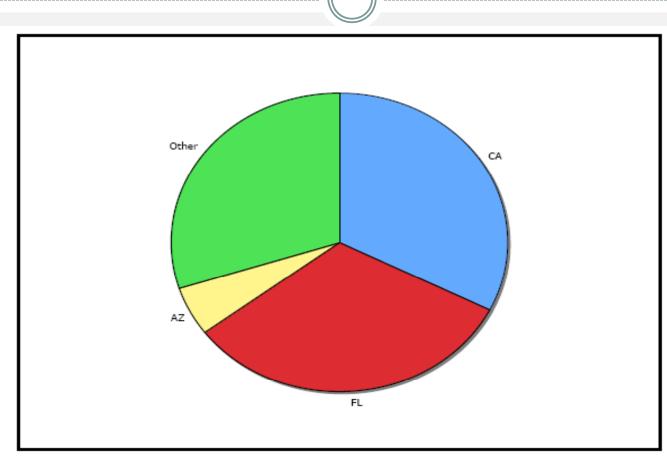
### Share of Installed Solar Hot Water and Space Heating Capacity by State in 2006-2007



IREC's 2009 Updates & Trends Report



### **Share of Installed Pool Heating Capacity by State** in 2006-2007



IREC's 2009 Updates & Trends Report



# Economic Impact of Solar Industry



#### **Types of Jobs in PV and CPS Industries**

- **Manufacturing positions** including factory worker, sheet metal worker, glass worker, technician, material handler, factory supervisor, manufacturing manager, engineer, material scientist.
- **Installation positions** including solar system installer/technician (PV), solar system designer (PV), technical sales representative and estimator (PV), architect (PV), roofing contractor (PV), general contractor, supervisor/foreman, heavy construction worker, welder, pipefitter, engineer.
- Administrative and support positions including administrative assistant, purchasing agent, accountant, health and safety officer, information technology professional, director.



### The Current Employment in the Global and U.S. Solar Industry

- Estimated 173,000\* people were employed in the solar industry in 2009 (2009 New Energy Finance study)
  - 169,000 jobs in the PV industry
  - 4,000 jobs in the Concentrating Solar Power (CSP) industry
- An earlier study by the United Nations Environment Program in 2008 estimated the global PV employment in five leading countries to be approximately 170,000.
- A new study by Navigant Consulting estimated additional 50,000 jobs in solar industry by 2025 with establishing 25% renewable electricity standard.



<sup>\*</sup> These are direct and direct jobs not including induced jobs.

#### **Employment Impact of Solar Industry**

- Globally for every MWe (megawatt electrical) production, 23 jobs are being created including direct and indirect FTEs (McCrone et al. 2009)
  - 0.8 jobs in operation
  - 12 jobs in project construction
  - 10 jobs in manufacturing
  - 0.4 jobs in development and services



### **Unprecedented Federal Incentives for the Solar Investment**

- The Emergency Economic Stabilization Act of 2008 provides tax incentives including 8-year extensions of the business and residential solar **investment tax credits** (ITC).
- **Cash grants** in lieu of the ITC equivalent of 30% benefit based on the cost of solar property.
- **Manufacturing tax credit** for new investments in advanced energy manufacturing that is equal to 30% of the investment.
- 5-year **double declining-balance depreciation** (taken together, ITC and bonus depreciation provide tax benefit equal to 56% of the installed cost of a commercial solar system (Bolinger 2009)
- **Renewable energy loan guarantee** program providing guarantee of about \$91 billion of loans.
- State Energy Program providing \$3.1 billion to state energy offices
- Proposed federal FY2011 budget includes 22% increase for solar program including \$98.2 million for CSP and \$152 million for PV

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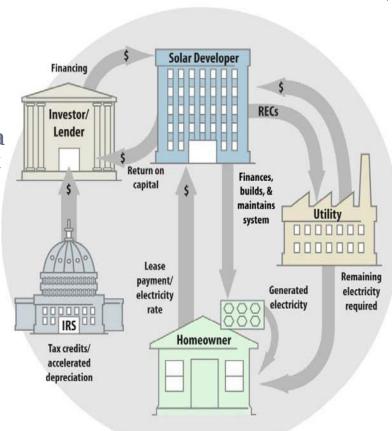
#### Two companies were recently awarded \$2 billion

- The Abengoa Solar company will build a solar plant in Arizona, which will be one of the largest solar plants in the world.
  - o In the short term, the construction of the plant is estimated to create approximately 1,600 jobs in Arizona.
  - Over 70 percent of the components and products used in the construction will be manufactured in the USA, boosting jobs and communities in states up and down the supply chain.
  - The plant will generate enough clean, renewable energy to power 70,000 homes.
- The Abound Solar Manufacturing company will manufacture advanced solar panels at two new plants, one in Colorado and the other in Indiana.
  - The plants will create more than 2,000 construction jobs and 1,500 permanent jobs.
  - When fully operational, they will produce millions of state-of-the-art solar panels each year.



#### **An Emerging Incentive: FIT**

- A feed-in tariff (FIT) is a requirement for utilities to purchase electricity from eligible renewable systems at a guaranteed price over a fixed period.
- Alternatively, a FIT could be in the form of a fixed or variable premium above the market price
- The payment system provides incentive to investors for recovering costs and making a modest profit
- FITs have been used extensively in Europe and are starting to be implemented in the U.S.
- Municipalities and counties across the U.S. are launching various FIT programs
- Gainesville Regional Utilities (GRU), the municipal utility serving Gainesville, Florida, implemented the first European type FIT in the U.S.



(NREL 2009b)

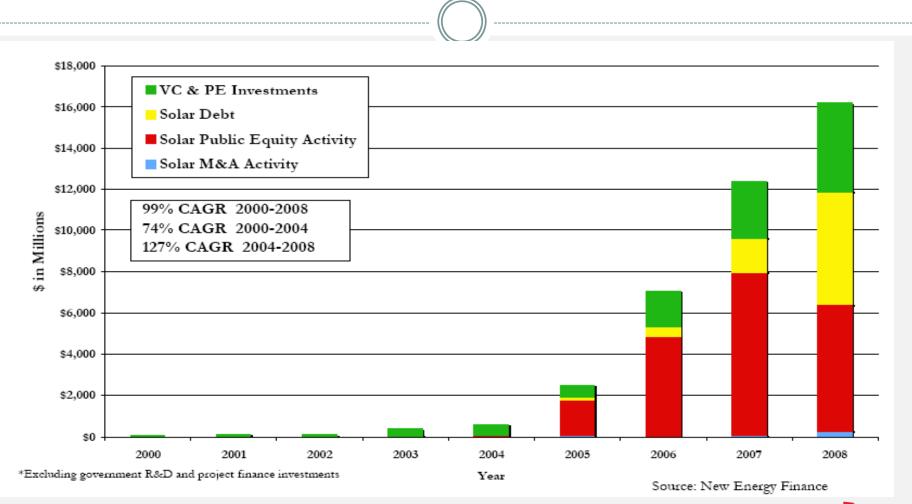


## Solar Investments & Future Outlook

Florida

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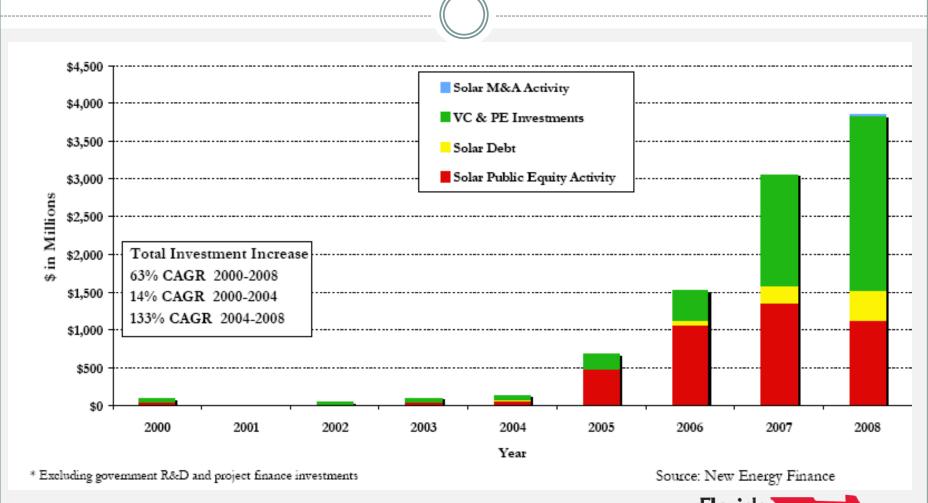
#### Global Capital Investments in Solar Energy



VC: Venture capital; PE: private equity; M&A: Mergers and acquisitions; CAGR: compound annual growth rate.



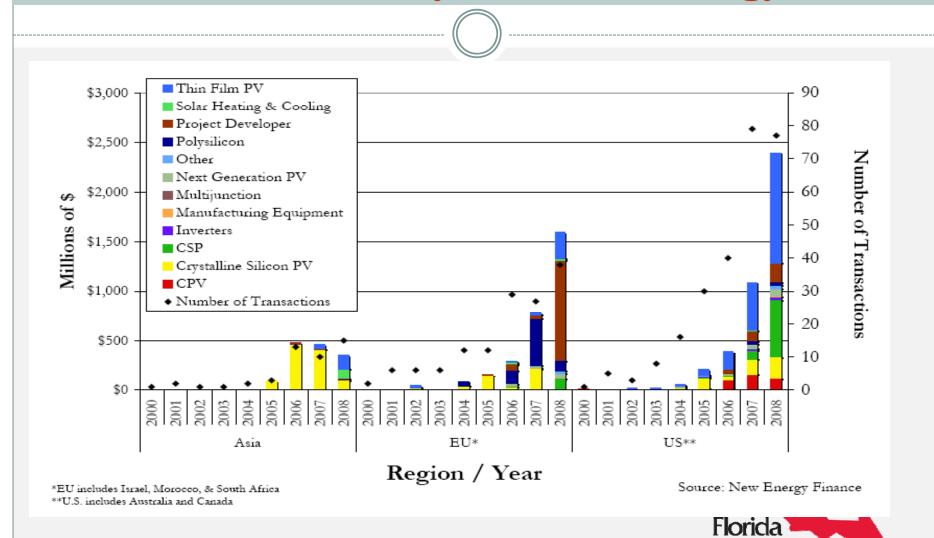
#### U.S. Capital Investments in Solar Energy



VC: Venture capital; PE: private equity; M&A: Mergers and acquisitions; CAGR: compound annual growth rate.

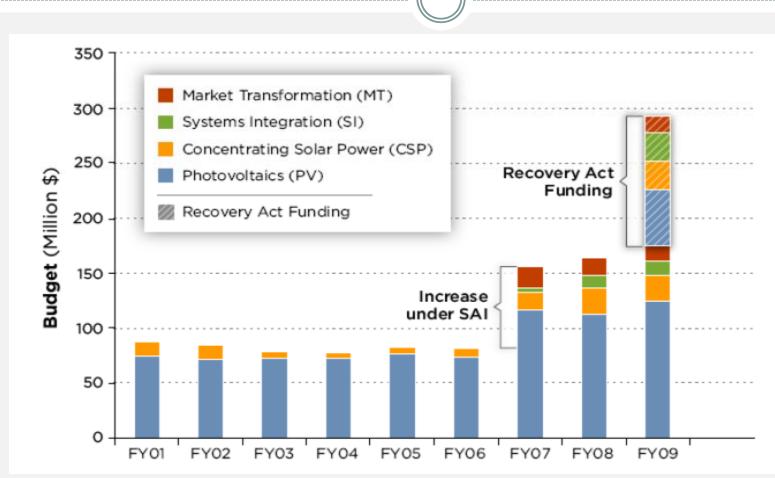


#### Global Venture Capital and Private-Equity Investments by Solar Technology



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#### U.S. Department of Energy Investment in Solar Energy

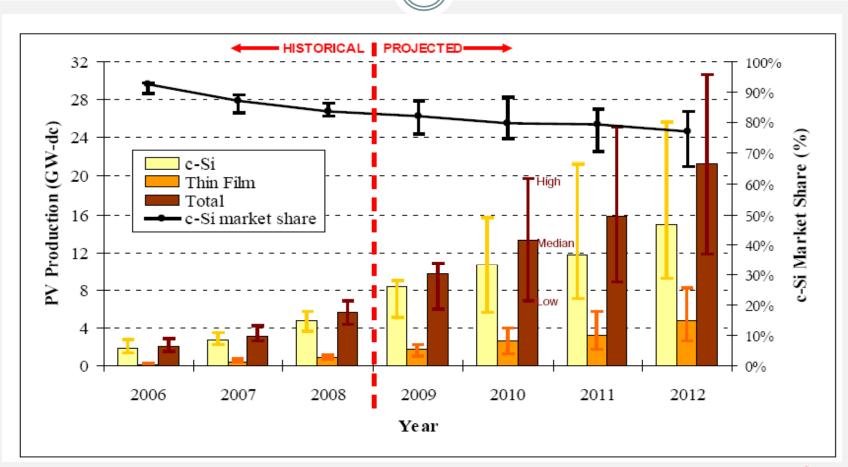


Source: 2008 Solar Technologies Market Report, January 2010.

**SAI: Solar America Initiative** 



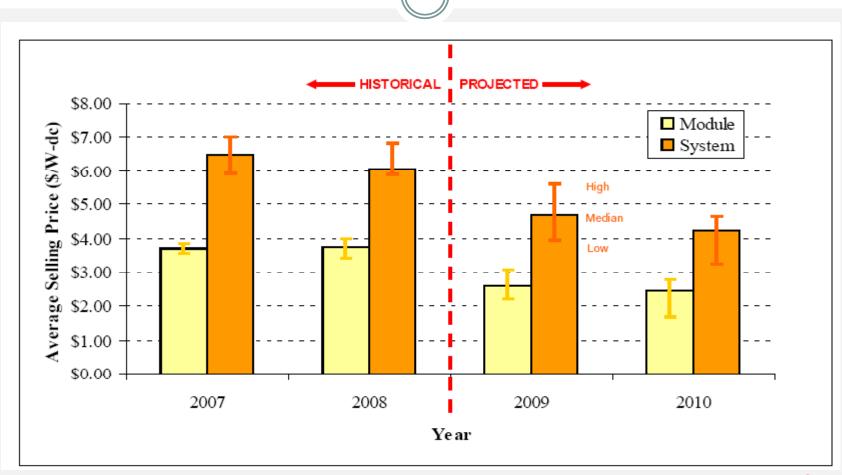
#### **Global PV Module Production Projections**



Source: 2008 Solar Technologies Market Report, January 2010.



#### **Global PV Module Price Projections**



Source: 2008 Solar Technologies Market Report, January 2010.



#### **CSP Market Projections**

#### Limitations on CSP versus PV

- 350 MW of CSP were built in the 1980s with no subsequent installations in the U.S. until 2005
- The installation costs for CSP are much higher

#### The future of CSP market

- The future of CSP markets looks very bright despite its limitations above
- A 2008 study by Prometheus Institute estimated \$80 to \$200 billion of aggregate investment in the CSP sector over the next 12 years.

Florida<sup>\*</sup>

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#### **Global GSP Planned Projects by 2015**

Country	Capacity
	(GW)
United States	6.5
Spain	4.2
India	0.46
Jordan	0.40
Israel	0.40
Italy	0.11
China	0.10
U.A.E	0.10
South Africa	0.10
Australia	0.083
Greece	0.062
Mexico	0.052
Oman	0.050
Egypt	0.030
Algeria	0.025
Morocco	0.020
France	0.012
Chile	0.010
Total	12.7
Bullard and d'Avack 2009	

U.S. market share (51%) Spain market share (33%)



## Upcoming TaxWatch Study: Estimating Direct, Indirect, and Induced Economic Impact of Expanding the Florida Solar Market

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### The Economic Benefits of Becoming A Hub of Solar Market

- Using well-known REMI model, the study will estimate the economic impact of additional investment in solar energy in terms of changes in:
  - Gross state product (GSP)
  - Employment
  - Personal earnings
  - State and local tax revenues



#### **Conclusion and Recommendation**

- Globally, the solar market has experienced tremendous growth, particularly in recent years
- Nationally, we are lagging behind Germany, Spain, & Japan, but doing better than the rest of the world
- The future of solar market looks brighter both globally and nationally. The global solar market is projected to triple in the next decade
- The bad news is that Florida is even behind Oregon in terms of producing electricity from solar energy, the good news is we could reverse the trend

  Florida

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#### THANK YOU



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