

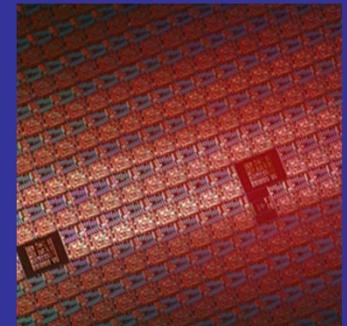
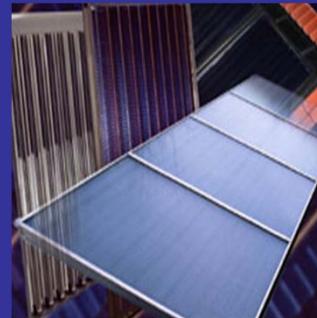


Continually cited as the model for a
successful industry/government consortium

Accelerating the next technology revolution

U.S. Photovoltaic Manufacturing Consortium

The journey to regaining U.S.
leadership in photovoltaics



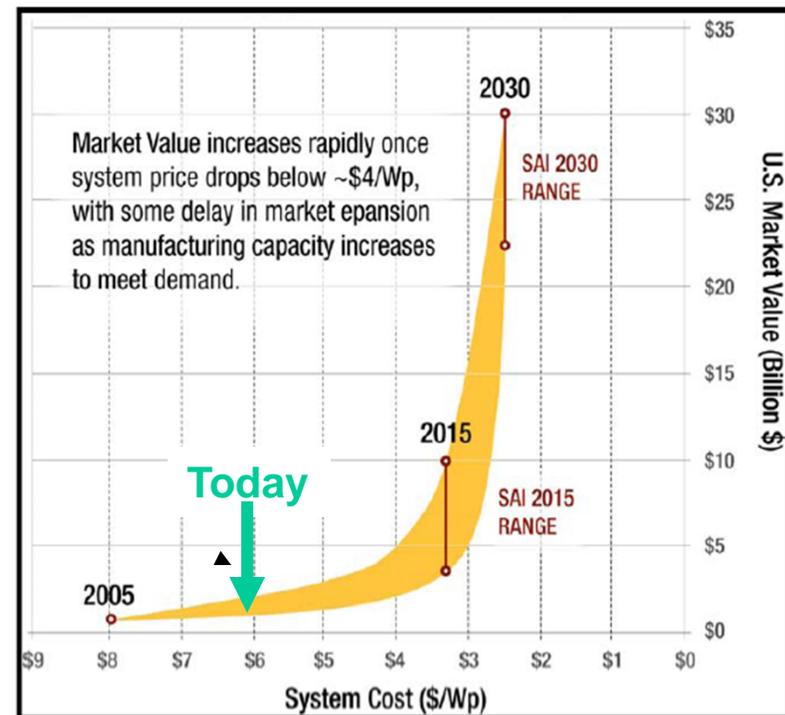
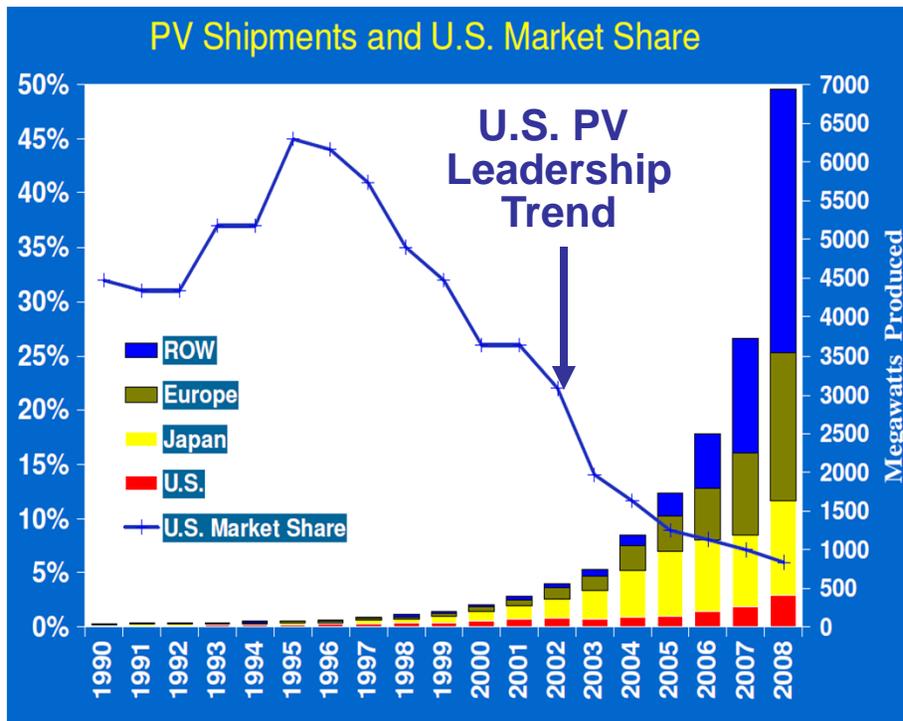
PV market trends and opportunities



U.S. continues to lose manufacturing leadership as the PV market grows at an exceptional rate - estimated below 5% World market share today

Present PV market has a CAGR >30%, and will ramp exponentially when system cost drops below \$4/Watt peak

* PV News (Prometheus) vol.28, pp 15-16, April 2009



PV create more jobs per MW than any other energy generation source

- PV: **23** Wind: **8** Nuclear: **4** Natural gas: **3** Coal: **0.5**

DOE PV Manufacturing Initiative



DOE Solar Energy Technologies Program Peer Review - March 11, 2009

An industry consortium is necessary to work on standardization and collaborative research opportunities, starting with PV manufacturing equipment. This is envisioned to be similar to “**Sematech’s**” role in the semiconductor industry and its influence on that industry’s supply chain.

National Academies U.S. PV Workshops - April and July 2009

- coordinate stakeholders and technology development efforts across the solar community to facilitate the development of a strong U.S. PV manufacturing industry
- Accelerate the implementation of new cutting edge PV technologies in the U.S.
- Develop highly trained U.S. PV workforce

SEMATECH-led PV Manufacturing Consortium Proposal

Funding Opportunity Announcement “Concept Paper” – submitted June, 2010

DOE DE-FOA-0000259 - full proposal submitted October 5th, 2010

DOE DE-FOA-0000259 - awards announced January, 2011

SEMATECH can contribute to other emerging technology industries – like Photovoltaics/Solar



- Experience in:
 - **Technology development** to accelerate commercialization
 - Advanced/emerging technology R&D programs
 - **Manufacturing productivity** programs
 - Develop/harden manufacturing, metrology, and test equipment
 - ESH
 - **Collaborative strategies** to build consensus, guide industry direction
 - Roadmaps and standards
 - **Recruiting, organizing consortia**
 - Methodology for collaboration among competitors
 - Managing IP protocols
 - Coordinating programs between industry, national labs, and universities
 - Leveraged funding

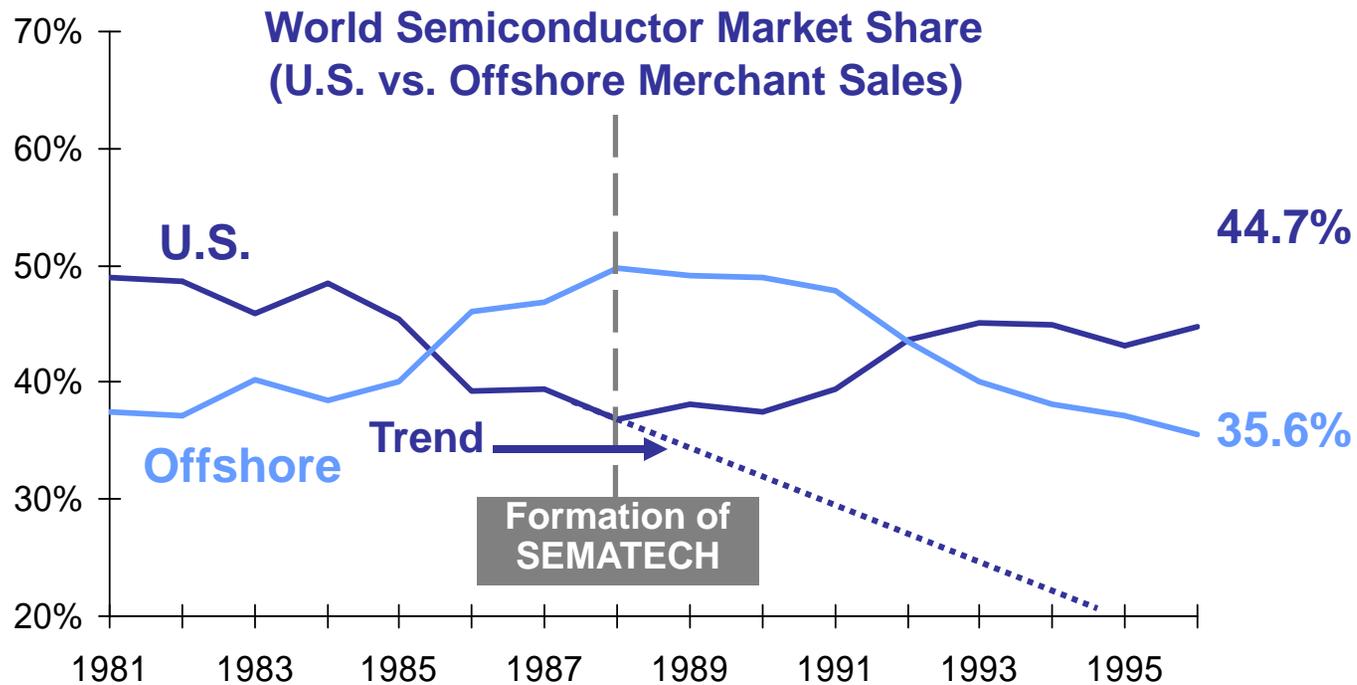
The SEMATECH effect

Semiconductor industry trend 1980s



“The most significant finding of the Task Force is that U.S. **technology leadership** in semiconductor manufacturing is rapidly eroding and that this has serious implications for the nation’s economy and immediate and predictable consequences for the Defense Department.”

- Defense Science Board Task Force
on “Semiconductor Dependency - **February 1987**”



Source: VLSI Research Inc.

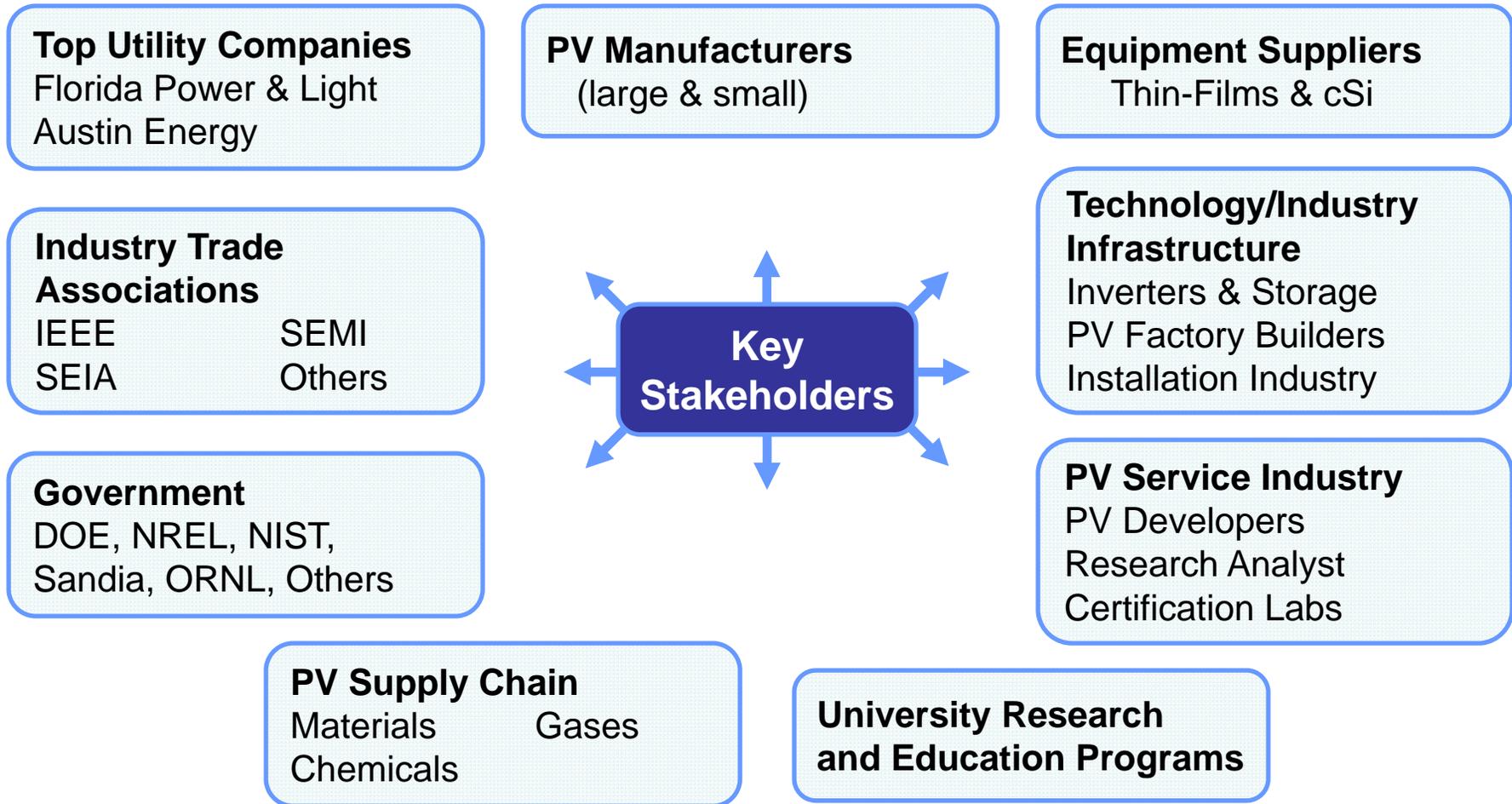
SEMATEC-led DOE Consortium Proposa



	University-Focused Consortium	Industry-Focused Consortium	Manufacturing Development Facility
Management	Consortium Management Organization (not-for-profit)	Consortium Management Organization (not-for-profit)	Single company (not-for-profit or for-profit)
Primary Performers	Universities	Industry companies – module companies, component companies, equipment suppliers	Primary customers are industry companies – startups and established companies
Additional Partners	Industry companies, others	Universities, State Economic Dev Organizations	Equipment and material suppliers
IP Ownership	University conducting research (or shared with corporate sponsor as determined by consortium)	Consortium	Company using facility
Non-DOE Revenue sources	Universities, Corporate Members	Corporate Members, Economic Dev Organizations, Equipment or Material Suppliers	Investors, User Fees, Equipment or Material Suppliers
DOE Funding	\$5M year total for 5 years	\$25M per year initial with decrease over 5 years	
Cost-Share	20% non-Federal	50% non-Federal, with higher cost-share judged favorably	

U.S. PV manufacturing consortium

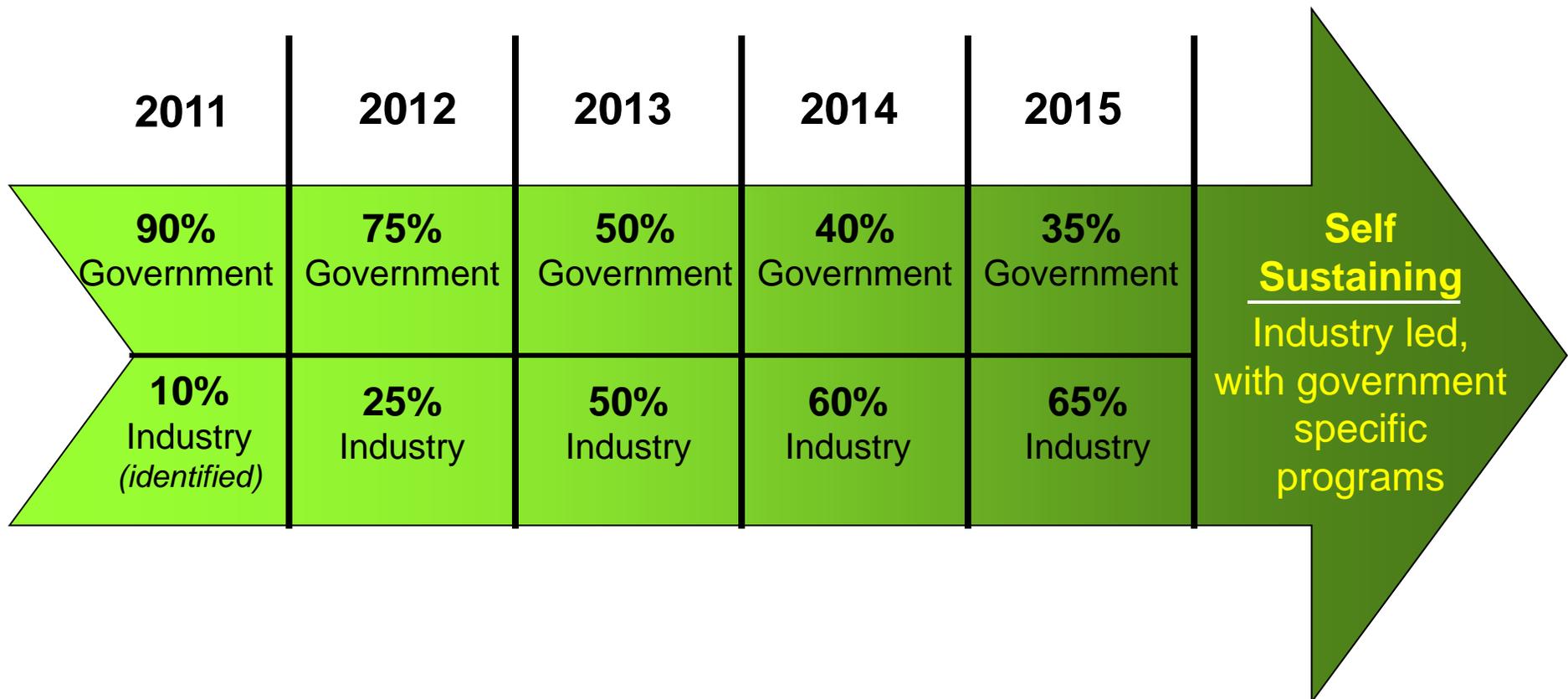
Ecosystem



PVMC Cost Share Model



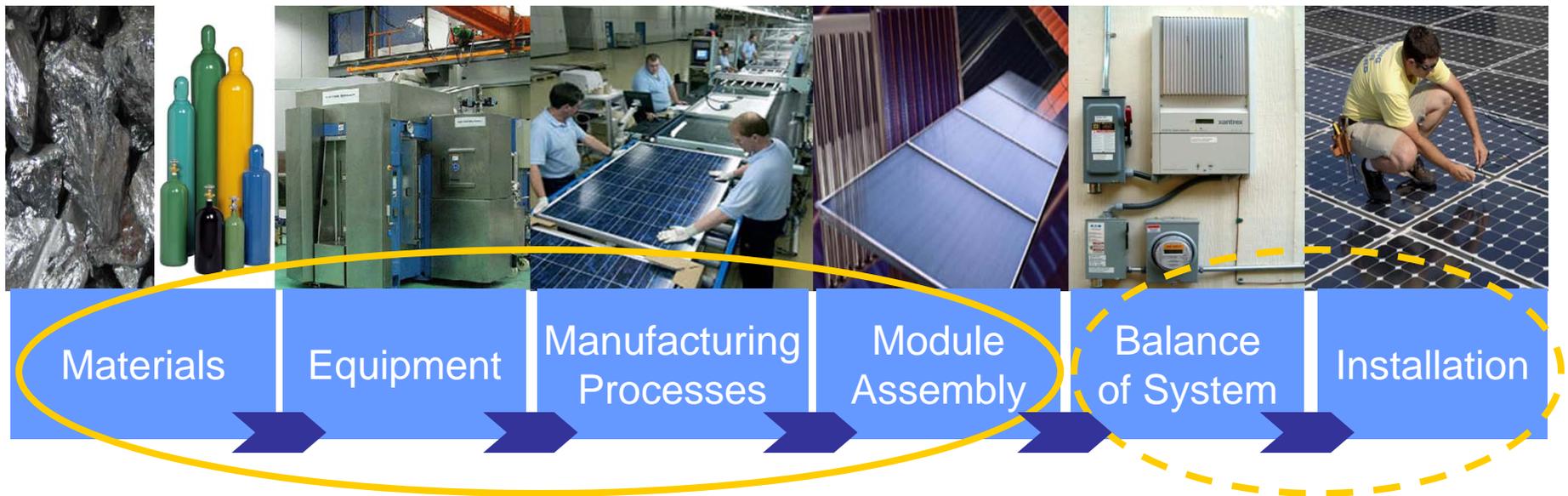
Consortium funding plans, >\$500M over 5 years



Solar energy manufacturing value chain



Technology innovation, productivity improvements and cost reductions needed across all sectors of the PV value chain



~35% total \$ reduction for "grid parity"

PVMC High-Level Program Proposal



- PV Manufacturing Development Facilities for next generation crystalline silicon cells and modules, thin film (CIGS), test/metrology/certification
 - lab-to-fab prototyping and product commercialization
- Develop and disseminate PV industry roadmap and standard
- PV materials characterization and integration
- Manufacturing productivity – process, equipment, and factory automation
- PV equipment co-development
- PV systems components – inverters, power electronics, diagnostics,...
- PV Innovation and Commercialization Centers
- Environment, Safety, and Health - and sustainability
- Certification/test/metrology – innovation and quality standards
- Policies/codes/permitting/renewable portfolio standards
- National labs and university programs
- Member company and industry application-specific programs
- Internships, education and workforce training programs

Industry/university/government collaboration in Albany



SEMATECH

- **Lithography**
 - EUV Mask Blanks
 - Resist Center
- **3D Interconnect**
- **Front End Technologies**
- **Metrology**

Investment to date: more than \$5.5 billion
Facility space to date: 800,000 square feet
Employees onsite: more than 2,500

University  **COLLEGE OF NANOSCALE SCIENCE & ENGINEERING**
UNIVERSITY AT ALBANY State University of New York

Industry   **TOSHIBA**   **NEC** 

Suppliers     

PVMC Florida

Innovation Center – Winter Springs, FL



Interdisciplinary Research-Incubation-Flexible Pilot Line

Advanced Test & Cert. Facility – Cocoa, FL

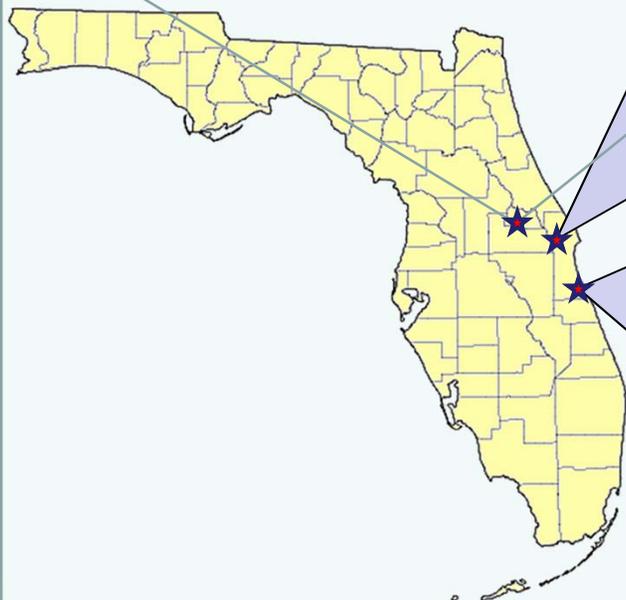


PV Cell and Module Testing, Aging, and Certification

PVMC Center – Palm Bay, FL



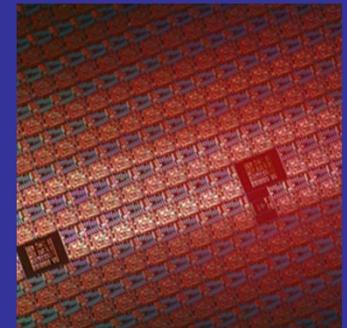
cSi PV Cell and Module Pilot Lines





Accelerating the next technology revolution

MJ Soileau
VP for Research and
Commercialization, UCF

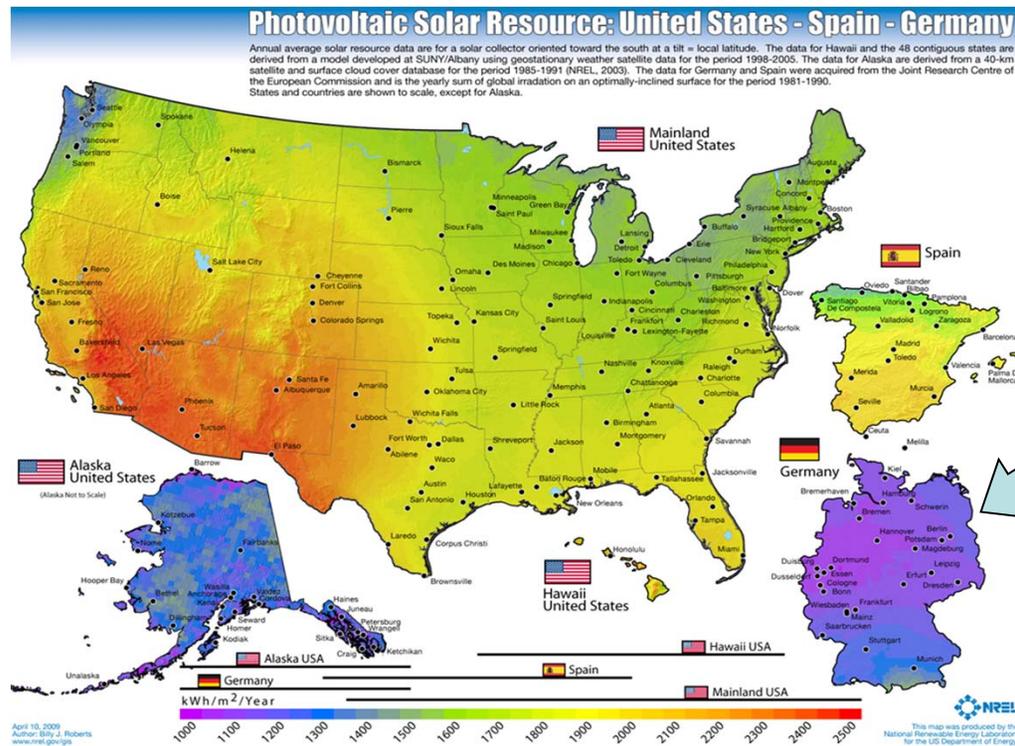


...I'd put my money on the
sun and solar energy.
Thomas Edison (1931)

Positioning the U.S. photovoltaic industry



The world is in the midst of an energy systems transformation, and the U.S. is positioned to become the world's largest PV market



Germany – leader in PV installations and manufacturing receives less annual solar radiation than North Dakota

As the U.S. economy recovers and the world experiences explosive growth in renewable energy, leadership in photovoltaic manufacturing is critical to U.S. energy production, national security, job creation, carbon reduction, and a strong sustainable economy.

Value of the Photovoltaic Industry



- The next significant global high-tech industry will be the manufacturing of photovoltaic (solar) modules
 - Substantial global focus on alternative clean energies and photovoltaics is the leading candidate for distributed energy
- The photovoltaic market is one of the fastest growing markets in the world and is expected to reach \$100B by 2014
 - CAGR of >30% expected through 2013
 - Market ramping exponentially when system prices drop below \$4/Watt peak (Wp)
- The number of PV modules that the U.S. is expected to deploy over the next decade is projected to create over 3 *million jobs*
 - ~50% of these jobs will be high-tech, high-paying manufacturing jobs
 - The other half will be technical installation and trade skills

*from Barclays Capital, solarbuzz, JRC European Commission

SEMATECH network

Bringing the industry, universities, and government together



Chip makers
IDMs, foundries
fabless, packaging



Universities
Over 60 universities
world-wide



Suppliers
Over 70 suppliers
in network



Governments
Local and regional
economic investments



New York
300mm wafer
processing



Texas
200mm wafer
processing



National Labs
EUV – LBNL
Metrology – NIST

Value of Long Term Advanced Technology Partnerships

Economic Impact Study



SEMATECH and New York

- Home to International SEMATECH HQ, the manufacturing arm of SEMATECH
- Attracted more than \$3.2 billion dollars in capital investment for AMD microchip plant
- Created nearly 500 high-tech, high-wage immediately
- Supporting more than 500 companies across the state as key anchor of Albany Nanotech Initiative

U.S. scaled estimates – more that 3.1 million permanent jobs

SEMATECH and Texas

- Played a critical role in national security initiative
- Key driver of the launch of Texas as a leading high-economy
- Attracted more than \$12 billion dollars in capital investment
- Created more than 80,000 high-tech, high-wage jobs: Texas
- Leader in government technology & economic development policy and investment

Semiconductor R&D has a multiplier effect of five (highest of all industries) resulting in an additional 400,000 ancillary jobs

U.S. Scaled Estimates

Based on U.S. capturing same share of global market as Texas captured in U.S. market, annual economic impacts of:

- \$482.8 billion in expenditures
- \$235.4 billion in gross domestic product
- \$141.8 billion in personal income
- \$50.3 billion in supported retail sales
- More than 3.1 million permanent jobs



“[SEMATECH North is] the most exciting development since the construction of the Erie Canal.”

***New York Governor
George Pataki
SEMATECH North
ribbon cutting, 2003***



[SEMATECH and the AMRC] will advance the technologies that will help drive our state's economy for the next 50 years.

***Texas Governor
Rick Perry
AMRC Launch***