Key: Establishing **Collaborative** Consortia

- PV Industry is historically fragmented
- How do you get consortium members – even direct competitors – to work together?

![Diagram showing Consortia Program connecting Company A, Company B, and Suppliers, distributing risk and cost, and accelerating progress.](image-url)
Initial PVMC cSi Program Areas

1. In-line/Off-line Metrology

Primary Goals
– Identify critical industry needs in metrology and rank
– Develop projects to demonstrate new cSi metrology technologies
– Transition new metrology technologies into pilot and manufacturing lines

Current 5-Yr Program Area Goal (revision expected by WG)
– >1,100 wft/hr in-line tool, reducing yield loss such that cost of insertion is offset completely

2. New Feedstock/Wafering Methodologies

Primary Goals
– Identify necessary feedstock/wafering targets for $/W
– Establish cSi feedstock/wafering programs to accelerate transition of new technologies into mainstream manufacturing
– Provide and foster process, test, and demonstration activities to validate new technologies and identify technical barriers

Current 5-Yr Program Area Goal (revision expected by WG)
– Demonstrate silicon usage efficiency < 3g/W and cSi wafer cost reduction of >50% to below $0.25/W.

*These two program areas are currently supported in FL through $14.5M of DOE and industry/partner matching funding*
Programs driven by identified areas of need

- Consortium members identify program area projects (working groups)

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<th>Cell Projects</th>
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</table>

- Identical paretos for feedstock/wafering, modules, and manufacturing productivity.

- Program area ranking allows prioritization of projects and selection of asset allocation

Please Contact Winston Schoenfeld For Full Slide Content Request
So….What is the Unique Opportunity for Florida ???

- Currently, Florida is one of only 2 states running the first U.S. PV manufacturing consortium
- Florida houses the cSi arm of the PVMC – a conversion technology that has maintained 80% market share for over a decade.
- We have the potential to grow into something much larger….
Supply Chain Strength in the U.S.

PVMC-FL can build from existing U.S. leadership in several areas of the cSi PV supply chain – smaller barrier for growth and job creation

**R&D Partners**
- IBM
- NREL
- ORNL
- SRC
- NIST
- ASU
- SUNY
- UCF
- SRI
- Sandia
- Sandia
- SEMI
- ISMI
- MIT
- UCLA
- FSEC

**Material Suppliers**
- MEMC
- ATMI
- 1366
- Crystal Solar
- JT Baker
- Saint Gobain
- Solsil
- Dow
- Orion
- 3M

**Equipment Suppliers**
- Schmid
- Spire
- TEL
- Roth & Rau
- Varian
- Ulvac
- Consarc

**Metrology Suppliers**
- Semilab
- Boeing/Spectrolab
- FEI
- Keithley
- Agilent
- Newport
- Ultrasonic Tech
- KLA

**Module Producers and Integrators**
- Suniva
- Ampulse
- Intersil
- SemiSouth
- Solar Power Ind.
- Calisolar
- FP&L / NextEra
- Lockheed Martin
- Progress Energy
- Austin Energy
- TSEC

**End-Users**
- Must Expand Programs to Include the Diverse Supply Chain
What the U.S. cSi Industry Needs

<table>
<thead>
<tr>
<th>The challenge</th>
<th>The PVMC solution</th>
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<tr>
<td>Industry alignment</td>
<td>Roadmap and standards</td>
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<tr>
<td>Lack of infrastructure</td>
<td>Collaborate to fund and create it</td>
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<tr>
<td>Lack of place to work</td>
<td>Advanced manufacturing development facility</td>
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<tr>
<td>Metrology, test and reliability</td>
<td>Develop, model, and share capabilities</td>
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<tr>
<td>Manufacturing cost – CIGS and cSi</td>
<td>Improved methods = reduced cost</td>
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<tr>
<td>Balance of system, technology commercialization, workforce development</td>
<td>Support to the industry</td>
</tr>
<tr>
<td>Cost of PV energy to consumer</td>
<td>Consortium = shared knowledge and resources and reduced cost of</td>
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<td>manufacturing = reduced cost to consumer</td>
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**PVMC cSi Manufacturing Development Facility is Essential**
Expansion Planned for PVMC FL – Phase II

- **Establish Next-gen RD&C Manufacturing Facility**
  - Next-gen cSi wafer-to-module *manufacturing*-scale lines for Consortium Projects
  - Critical value-added element of PVMC for industry, houses consortium and member company projects.
  - 100,000 ft\(^2\) site already available in Palm Bay, FL

- **Establish PV Commercialization Support Structure**
  - Support transfers into manufacturing, provide incubation and start-up support

- **Develop Training Workforce Development Programs**
  - College, university, MDF, and member company programs

- **National cSi Roadmap and Standards**
  - Identify industry drivers, establish Executive Steering Committee/Working Groups
Benefits to Florida

- Established Florida as cSi Manufacturing Hub of the U.S.

- Brings manufacturing technical challenges to the doorstep of University researchers

- Establishes a magnet for industry, bringing companies to the Florida doorstep

“The SEMATECH Effect”
Value of Long Term Advanced Technology Partnerships

**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

**SEMATECH and Texas**

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

**Economic Impact Study**

**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

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

**SEMATECH North**

“[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
Thank you for your attention !!!