

Catalyzing Innovation in PV Manufacturing



An NSF Workshop

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Golden, CO



Highlights and Summary of Facilitated Discussion

Session III – Partnerships for Innovation

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Dr. John Torvik, Novus Energy Partners

[Photovoltaics from a VC Perspective](#)

Overview

- Tremendous shakeout underway, margins shrinking, huge markets to open as LCOE approaches grid parity
- New Companies must have competitive technology (h, \$/Wp, \$/kWhr, CapEx), but also financing, bankable product, plan for warranties, economies of scale
- Most likely will have to self-finance initial projects
- No silver bullet technology: all could contribute in natural markets

Investment Opportunities

- Silicon: Improving Si utilization key
- Thin Film: Efficiency primary driver, non- vacuum processing
- Balance of Systems (BOS): Inverter technology, Module weight reduction, installation

Dr. Harin Ullal, National Renewable Energy Laboratory

[National R&D Thin Film Photovoltaic Teams: A Success Story](#)

Overview

- Gov-Academia-Industry Consortium (1993-2006), Funding on the order \$30M/year
- 3 R & D teams: a-Si, CdTe, CIGS
- Met Annually, research topics decided by consensus, industry vote counts 3:1
- Non-proprietary research, all members participate in team activities

Lessons Learned/Results

- Bring everyone into the room, but do not micro-manage
- Contributed to leading companies in each technology (First Solar, Uni-Solar, Global Solar)
- Excellent interaction among 3 sectors

Dr. Tom Smerdon, University of Colorado

[Effective Intellectual Property Management](#)

Overview

- Reviewed forms of IP: Copyright/Patent/Trademark/Trade Secret
- Protecting Patentability: When to file, disclose, use of provisional, etc.
- Key Ingredient: Proof of Concept Research. Not required for IP, required for commercialization

Dr. Robert Collins, University of Toledo

Overview of the Wright Center for PV Innovation & Commercialization (PVIC)

Overview of PVIC: Subset of State of Ohio's Third Frontier Project: 10 year, \$1.6B investment

- Academic Institutions: Toledo (Thin Film), OSU (Multi-junction/Nano), Bowling Green (OPV)
- \$18.6M total investment over 3 years
- Companies: 13 founding, 30 current participants
- Areas of Emphasis: (1) Imagine - (2) Incubate - (3) Demonstrate - (4) Market Entry- (5) Growth & Sustain

Center Projects: ~50/50 split between proprietary and non-proprietary research

- University research (IP owned by university; accessible to partners)
- Collaborative research (joint ownership of IP)
- Service research (IP owned by industry member)

Examples

- Areas #1 - #2 Photon Management for Advanced Thin Film PV
- Areas #2 - #3 Novel Approach: Process Development in Roll-to Roll and Rigid Substrate PV Guided by Monolayer Sensitive in Situ Mapping Optics
- Area #3 - #4 Example: Low Cost PV Systems – Solar Kits
- Area #5 Progress in Education at Univ. Toledo: New School and Professional Masters Program

Session III: Partnerships for Innovation – Panel Discussion

Comment #1: Key area for investment: Proof of concept stage. Is \$150K (SBIR Phase I) sufficient? Would a better investment be more money into fewer projects?

Comment #2: Successful collaborations involving multiple institutions (PV Partnership, PVIC) require long-term (~10 year) commitments and significant investment (>\$10M). Closest NSF program is the ERCs. Otherwise generally limited to 1 on 1 collaborations, which typically involve IP and have limited impact beyond participating entities.

Comment #3: Good practice for centers is to clearly delineate pre-competitive research from that involving IP. Staff appropriately with grad student vs. professional staff, respectively

Comment #4: Best opportunities for new companies are in specific elements in the value chain, as opposed to a full PV company. Keys will be to partner.



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