2014 Solid-State Lighting R&D Workshop

A Broader Look at Government SSL Support

January 29, 2014
DOE Program Leadership Shapes SSL R&D

RESEARCH & DEVELOPMENT
- Core Technology Research
- Product Development
- Manufacturing

MARKET DEVELOPMENT
- Utilities
- Energy Efficiency Programs
- Municipalities
- Manufacturers
- Designers
- Specifiers
- Retailers
- Distributors

Communications & Planning

Market-Ready Energy-Efficient Products
Strategic Vision Defined in MYPP and Roadmap

• Industry input from Roundtables and Workshops shape MYPP/Roadmap priorities and DOE solicitations
Solicitation Goals

• Maximize the energy-efficiency of SSL products in the marketplace
• Remove market barriers through improvements to lifetime, color quality, and lighting system performance
• Reduce costs of SSL sources and luminaires
• Improve product consistency while maintaining high quality products
• Encourage the growth, leadership, and sustainability of domestic U.S. manufacturing within the SSL industry
SSL Program Guides Many Related Government Efforts

• Collaboration, coordination create a bridge between related efforts

SSL Program R&D, Market Development Support

Small Business Innovation Research (SBIR) Program

Energy Frontier Research Centers (EFRCs)

Advanced Research Projects Agency-Energy (ARPA-E)

Advanced Manufacturing Office

National Science Foundation SBIR Program
Core Technology Research

- Applied research to fill SSL technology gaps, provide enabling knowledge or data
- Particular emphasis on meeting technical targets for performance and cost
- Funded by SSL Program
- Guided by Multi-Year Plan priorities and targets

www.ssl.energy.gov/projects.html
Look for these posters:

- **Poster 1**: High Efficiency and Stable White OLED using a Single Emitter (Arizona State University)

- **Poster 6**: High Efficacy Green LEDs by Polarization Controlled MOVPE (Rensselaer Polytechnic Institute)

- **Poster 7**: Lattice Mismatched GaInP Alloys for Color Mixing White Light LEDs (National Renewable Energy Laboratory)

- **Poster 10**: Low-Cost, Highly Lambertian Reflector Composite for Improved LED Fixture Efficiency and Lifetime (WhiteOptics)

- **Poster 24**: Light Emitting Diodes on Semipolar Bulk GaN Substrate with IQE > 80% at 150 A/cm² and 100°C (Soraa)
Product Development

- Use of applied research to develop or improve commercially viable SSL materials, devices, or systems
- Focus on a targeted market application with fully defined price, efficacy, and other performance parameters
- Funded by SSL Program
- Guided by Multi-Year Plan priorities and targets

Poster 9:
High Power Warm White Hybrid LED Package for Illumination (Philips Lumileds Lighting)

www.ssl.energy.gov/projects.html
Manufacturing R&D

• R&D to achieve cost reductions through improvements in manufacturing, while maintaining or enhancing performance

• Focus on significant leaps in SSL manufacturing equipment, processes, or monitoring techniques, and on fostering U.S.-based manufacturing

• Funded by SSL Program

• Guided by Manufacturing R&D Roadmap

• Focus of separate workshop, May 7–8, 2014

www.ssl.energy.gov/projects.html
FY14 SSL Program FOA

- One FOA covers all three areas: Core Technology, Product Development, and Manufacturing R&D
- New process to streamline timing and feedback

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<th>New FOA Process</th>
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Market Development Support

- Strategic efforts designed to overcome barriers to market adoption
- Closely coordinated with R&D progress to ensure appropriate applications, avoid buyer dissatisfaction
- Funded by SSL Program
- Guided by Market Development Support Plan
- Focus on separate workshop, November 11–13, 2014
- Testing, demonstrations, and analysis expand our knowledge base

www.ssl.energy.gov/market.html
Studies and reports present objective market and technical analysis

– **Poster 18**: Adoption of Light-Emitting Diodes in Common Lighting Applications—Snapshot of 2013 Trends (Navigant)

Design competitions drive innovation, draw attention to well-designed products

– Check out the **Next Generation Luminaires™ exhibits**

Workshops, roundtables, working groups identify needs, address critical issues

– Reliability Consortium and RTI efforts, see **Poster 2**: System Reliability Model for SSL Luminaires (RTI International)
Small Business Innovation Research

- Annual solicitations increase participation of small businesses in federal R&D, include topics related to SSL
- Funded by DOE Office of Science, Basic Energy Sciences Program
- Research topics identified by SSL program, grants managed by SSL program

**Poster 4:** Dielectric Printed Circuit Board Planar Thermosyphon (Advanced Cooling Technologies)

**Poster 5:** Low Cost Printed Electrodes for OLED Lighting (Plextronics)

http://www.science.energy.gov/sbir
Small Business Innovation Research

**Poster 11:** Solutions for OLED Lighting (Universal Display Corporation)

**Poster 12:** Highly Efficient and Smart Power Supplies to Drive Phosphorescent OLED Lighting Panels (InnoSys)

**Poster 13:** A Novel OLED Luminaire System for Specialty Lighting Applications (Litecontrol)

**Poster 22:** Low Cost, Scalable Manufacturing of Microlens Engineered Substrates (MLES) for Enhanced Light Extraction in OLED Devices (Sinmat)
Energy Frontier Research Centers

• Support fundamental, longer-horizon energy research
• EFRCs with SSL R&D include: UCSB, USC, Sandia, CalTech, Carnegie Institution, MIT, LANL, U of Michigan
• Funded by DOE Office of Science, Basic Energy Sciences Program
• 2011 EERE/SSL and OS/BES Roundtable on science challenges
  – www.ssl.energy.gov/techroadmaps.html

Poster 17: Breakthrough Basic Research on the LED Droop Mechanism (University of California, Santa Barbara)

Poster 20: Laser Diodes for Solid-State Lighting (Sandia National Laboratories)

Poster 21: Revealing the 3-D Structure of Nanowire LEDs (Northwestern University)
Advanced Research Projects Agency — Energy

- Supports high-potential energy-related R&D considered “too early” for private investment
- Includes topics related to SSL

**Poster 8:** Ammonothermal Bulk GaN Crystal Growth for Energy Efficient Lighting (Soraa)

**Poster 15:** Metacapacitors for LED Lighting (CUNY Energy Institute)

**Poster 16:** Advanced Power Electronics for LED Drivers (MIT)
Invests in innovative technology, shared infrastructure and facilities, and education and workforce development in support of the President’s Advanced Manufacturing Partnership

• Innovative manufacturing institutes focus on development of transformational manufacturing technologies

• New institute in North Carolina focuses on wide bandgap semiconductor-based power electronics
  – Applicable to multiple industries including SSL
• Additional funding for SBIR projects
• More on this from Steve Konsek

**Poster 14:** Thin-film Silicon Transistors Monolithically Integrated with LED Devices (Lumiode)

**Poster 19:** Silicon Nanoparticle Phosphors for LED General Illumination (LumiSands)
DOE SSL Program Provides National Leadership

• SSL Program is a collaborative, cooperative partnership — with the lighting industry, research community, national labs, and market sector partners

• DOE Multi-Year Plan provides guidance for:
  – Various DOE efforts
  – U.S. and global efforts

• This is your opportunity to participate
  – More on this from Fred Welsh

• Sign up for regular updates on SSL Program activities

www.ssl.energy.gov